TEXT FLY WITHIN
THE BOOK ONLY

HYDROGRAPHICAL AND BIOLOGICAL INVESTIGATIONS

IN

NORWEGIAN FIORDS

BERGENS MUSEUM

HYDROGRAPHICAL AND BIOLOGICAL INVESTIGATIONS

IN

NORWEGIAN FIORDS

By

O. NORDGAARD

THE PROTIST PLANKTON AND THE DIATOMS IN BOTTOM SAMPLES

BY

E. JØRGENSEN

WITH 21 PLATES AND 10 FIGURES IN THE TEXT

BERGEN
JOHN GRIEG
1905

PREFACE.

In the present work, I have collected the results of the hydrographical and biological investigations made by me in some of the fiords in the north of Norway, in the winter of 1899 and 1900, when at the cost of the Norwegian government and the Bergen Museum I made investigations in the fishing waters of Lofoten. For this purpose, I hired a little steamer „Gunnar Berg" from January to the beginning of May, 1899. During these months, observations were made in the Vest Fiord and in the sea beyond Lofoten, Vesteraalen, Senjen and Finmarken. Several fiords were also visited, as for instance, the Kirk, the *Øgs*, the Kanstad, the Sag, the Tys and the Ofoten Fiords, Skjomen, Rombaken, Malangen, Lyngen, Kvænangen (including the Jøkel Fiord), the Porsanger Fiord etc.

In the winter of 1900, S/S „Asbjørn Selsbane" was hired for one month, so that investigations might be made in the fishing banks which would furnish material with which to compare the results obtained the previous year. We were also able to visit the Morsdal, Salten, Skjerstad and Folden Fiords. Of these, the Skjerstad Fiord proved to be especially interesting.

The following apparatus were used:—

1. Dr. PETTERSON's water bottle and meter wheel,
2. A crab with 1000 meters af bronze-line,
3. German nets for plankton gatherings,
4. Dr. PETERSEN's closing net,
5. Dredges and a small trawl for zoological gatherings,
6. Lines and ropes.

The dredges and trawl were drawn up by the steam winch, but we took in the water bottle and the plankton nets with one worked by hand.

I had a very capable assistant, Mr. NIELS HAAGENSEN, both winters, he rendered very great service in many ways. For the sake of uniformity, I took all the temperatures personally. In determining the zoological material, I have had many helpers, Norwegians and foreigners. But, unless otherwise stated, I am personally responsible for the arrangement of the species, and for the remarks, which, in some cases, are added. I am especially indebted to my friend, Mr. E. JØRGENSEN, for his exceedingly careful treatment of the Protistplankton and the Diatoms in the Bottom samples.

To the following naturalists, I also wish to tender my hearty thanks for their kind assistance, viz:—

A. APPELLÖF, O. BIDENKAP, Miss K. BONNEVIE, EDW. BROWNE, O. CARLGREN, R. COLLETT, M. FOSLIE, HERMAN FRIELE, JAMES GRIEG, R. HARTMEYER, JOHAN KIÆR, HANS KIÆR, J. HUITFELDT-KAAS, G. W. R. LEVINSEN, W. LUNDBECK, R. C. PUNNETT, G. O. SARS, J. SPARRE SCHNEIDER and HJ. ÖSTERGREN.

My thanks are also due to the Norwegian government officials and to the managing board of the Bergen Museum, for having been by them enabled to undertake these investigations. Finally, I would especially thank the Director of the Bergen Museum, Dr. J. BRUNCHORST, who has, in so many ways, given me valuable assistance.

Borgen, 8/11 1904.

O. Nordgaard.

CONTENTS.

ERRATA.

Page 8, line 2 from foot, for 150 m. (sample nr. 154), read 180 m.
— 9, for Landego 3° 19′ E, read Landego 14° 4′ E.
— 9, for Arnø 3° 15′ E, read Arnø 14° E.
— 10, line 2 from foot, for E t S, read E b S.
— 172, line 21, for *Rhamphostella*, read *Rhamphostomella*.

I. HYDROGRAPHY.

NOTES.

The water samples were taken by means of prof. Pettersson's water-bottle and the titration has been made at the laboratory of the Bergen Biological Station by Messrs. Thomas Mathiesen (samples of 1899) and Ragnar Barman (samples of 1900) according to the methods of prof. Pettersson. I have made every temperature observation myself with a termometer of dr. H. Geissler Nachf. Frz. Müller in Bonn.

The distances of the tables are expressed in nautical miles (= 1852 metres).

A. Observations at the Northern Coast and in the Northern Fjords.

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents: Cl. per litre	Salt per litre	Salt per mille
	January	Høla at Svolvær	Metres	Metres	C^0			
1	11	$68^0$10'.5 N.,	150	0	3.3	18.79	34.00	33.16
2		$14^0$35'.5 E.		10	3.5	18.79	34.00	33.16
3				20	3.6	18.79	34.00	33.16
4				30	3.7	18.79	34.00	33.16
5				40	3.7	18.79	34.00	33.16
6				50	3.7	18.82	34.05	33.21
7				80	3.8	18.82	34.05	33.21
8				100	4.6	18.82	34.05	33.21
9				110	6.4	19.37	35.04	34.17
10				127	6.6	19.45	35.18	34.30
11				150	6.6	19.58	35.41	34.52
12		Outside Skroven.		0	4.0	18.85	34.11	33.26
13		Between Grøtø		0	4.4	18.92	34.23	33.39
14		and Skroven.		10	4.4	18.92	34.23	33.39
15		In the middle of		20	4.4	18.92	34.23	33.39
16		the Vestfjord.		30	4.5	18.92	34.23	33.39
17				40	4.6	18.92	34.23	33.39
18				50	4.8	18.99	34.36	33.50
19				60	5.0	18.99	34.36	33.50
20				70	5.3	18.99	34.36	33.50
21				80	6.3	19.13	34.60	33.74
22				100	6.9	19.48	35.24	34.35
23				150	6.3	19.68	35.59	34.69
24				200	6.3	19.79	35.78	34.87
25				250	6.2	19.79	35.78	34.87
26	12	Off Fladø.		0	4.2	18.89	34.18	33.33
27		4 miles W of		0	4.2	18.89	34.18	33.33
		Husøbaran.						
28		10 miles NW of		0	4.3	18.92	34.23	33.39
29		Helligvær.		10	4.3	18.92	34.23	33.39
30				20	4.3	18.92	34.23	33.39
31				30	4.4	18.92	34.23	33.39
32				50	4.4	18.92	34.23	33.39
33				80	5.0	18.99	34.36	33.50
34				100	5.0	19.17	34.68	33.82
35				110	7.0	19.41	35.10	34.23
36				120	7.3	19.58	35.41	34.52
37				140	7.6	19.71	35.64	34.74
38				150	7.6	19.71	35.64	34.74
39				200	7.4	19.86	35.91	34.99
40				250	7.3	19.93	36.04	35.11
41	13	Vestfjord I.	180	0	4.6	18.99	34.36	33.50
42		Between Helligvær		10	4.7	18.99	34.36	33.50
43		and Værø in the		20	4.7	18.99	34.36	33.50
44		middle of the fjord.		30	4.8	18.99	34.36	33.50
45				50	4.9			
46				80	5.1	19.07	34.50	33.65
47				100	5.3	19.10	34.56	33.70
48				110	6.7	19.41	35.10	34.23
49				120	7.2	19.45	35.18	34.30
50				130	7.2	19.55	35.36	34.47
51				150	6.4	19.61	35.47	34.57
52				180	6.5	19.61	35.47	34.57
53		Vestfjord II.	225	0	3.9	18.85	34.11	33.26
54		Between Vestfj. I		10	4.0	18.85	34.11	33.26
55		and Værø.		20	4.0	18.85	34.11	33.26
56				30	4.6	18.92	34.23	33.39
57				50	4.6	18.92	34.23	33.39
58				80	4.8	18.99	34.36	33.50
59				100	6.4	19.27	34.86	34.00
60				120	7.2	19.41	35.10	34.23
61				150	7.6	19.61	35.47	34.57
62				200	7.2	19.79	35.78	34.87
63				225	6.8	19.82	35.84	34.92
64	14	Off Mosken.		0	3.9	18.85	34.10	33.26
65		Moskenstrømmen.		0	4.0	18.85	34.10	33.26
66		Moskenstrømmen.	150	0	4.1	18.92	34.23	33.39
67		10 miles SOtO of		30	4.3	18.92	34.23	33.39
68		Evenstad.		50	4.5	18.96	34.31	33.46
69				80	4.6	18.96	34.31	33.46
70				100	4.7	18.96	34.31	33.46
71				120	5.4	19.13	34.60	33.74
72				150	6.5	19.65	35.54	34.64
73	17	Reine.	180	0.	4.18	18.92	34.23	33.39
74		8 miles SO of R.		10	4.2	18.92	18.23	33.39
75				30	4.3	18.92	18.23	33.39
76				50	4.3	18.92	18.23	33.39
77				80	4.3	18.92	34.23	33.39
78				100	5.1	19.09	34.54	33.68
	January		Metres	Metres	C^0			
79	17	Reine.		110	7.0	19.41	35.10	34.23
80				130	7.1	19.51	35.27	34.40
81		Stamsund.		0	3.9	18.89	34.18	33.33
82		8 miles StO of	150	10	4.1	18.92	34.23	33.39
83		Stamsund.		30	4.2			
84				50	4.3	18.92	34.23	33.39
85				80	4.45	18.96	34.31	33.46
86				100	5.5	19.13	34.60	33.74
87				120	6.9	19.51	35.28	34.40
88				150	6.8	19.58	35.41	34.52
89		Henningsvær.	180	0	4.2	18.92	34.23	33.39
90		7 miles S of.		10	4.2	18.92	34.23	33.39
91	18	Yttersiden.	110	0	4.1	18.99	34.36	33.50
92		Outside the Lofoten		10	4.6	18.99	34.36	33.50
93		islands.		20	4.6	18.99	34.36	33.50
94				30	4.6	18.99	34.36	33.50
95				50	4.7	18.99	34.36	33.50
96				60	4.9	19.07	34.50	33.65
97				80	5.5	19.20	34.74	33.87
98		Gaukværo.	250	0	4.1	19.02	34.42	33.56
99		$68^0$35' N.,		10	4.4	19.02	34.42	33.56
100		$14^0$13' E.		20	4.5	19.02	34.42	33.56
101				30	4.5	19.02	34.42	33.56
102				80	5.6	19.30	34.91	34.04
103				150	6.9	19.43	35.14	34.27
104				250	7.1	19.50	35.27	34.38
105	19	Havet.		0	5.9	19.50	35.27	34.38
106		40 miles NNW of		10	6.2	19.50	35.27	34.38
107		Gaukværo.		20	6.4	19.50	35.27	34.38
108				30	6.4	19.61	35.47	34.57
109				40	6.4	19.50	35.27	34.38
110				50	6.4	19.50	35.27	34.38
111				80	6.7	19.50	35.27	34.38
112				100	6.9	19.58	35.42	34.53
113				120	7.0	19.58	35.42	34.53
114				150	6.8	19.58	35.41	34.52
115				200	6.7	19.58	35.41	34.52
116				250	6.6	19.58	35.41	34.52
117				300	6.5	19.58	35.41	34.52
118				400	6.2	19.58	35.41	34.52
119				500	5.9	19.50	35.27	34.38
120				600	4.2	19.50	35.27	34.38
121				700	3.6	19.50	35.27	34.38
122				800	2.0	19.43	35.14	34.27
123				1000	2.0	19.43	35.14	34.27
124		32 miles NNW of		0	5.0	19.16	34.66	33.84
		Gaukværø.						
125		24 miles NNW of		0	4.0	18.77	33.96	33.13
		Gaukværø.						
126	21	Senjen.	130	0	3.3	18.77	33.96	33.13
127		12 miles NWtW of		10	3.9	18.77	32.96	33.13
128		Maanesodden.		20	3.9	18.77	33.96	33 13
129				40	3.9	18.77	33.96	33.13
130				50	4.3	18.77	33.96	33.13
131				80	4.5	18.89	34.18	33.33
132				100	4.6	18.89	34.18	33.33
133				120	4.4	18.89	34.18	33.33
134	23	Tromsøsund.		0	0.6	19.00	34.[illegible]8	33.53
135	24	Kvænangen I.	150	0	3.6	19.32	34.95	34.08
136		Between Løgø and		10	3.7	19.32	34.95	34.08
137		Brynilen.		20	3.7	19.32	34.95	34.08
138				30	3.7	19.32	34.95	34.08
139				40	3.9	19.32	34.95	34.08
140				50	3.9	19.32	34.95	34.08
141				80	3.9	19.32	34.95	34.04
142				100	3.9	19.32	34 95	34.08
143				120	3.9	19.32	34 95	34.08
144				140	4.0	19.32	34.95	34.08
145		Kvænangen II.	180	0	2.6	19.20	34.74	33.87
146		$70^0$1' N.,		10	2.6	19.20	34.74	33.87
147		$21^0$28'.5 E.		20	2.6	19.20	34.74	33.87
148		Between Spilderen		30	2.6	19.20	34.74	33.87
149		and Kvænangs-		50	2.6	19.20	34.74	[illegible]3.87
150		tinderne.		80	2.6	19.20	3[illegible].74	33.87
151				100	2.6	19.20	34.74	33.87
152				120	2.6	19.20	34.74	33.87
153				150	2.8	19.20	34.74	33.87
154				150	3.1	19.20	34.74	33 87
155	27	Lyngen I.	118	0	1.1	19.20	34.74	33.87

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	January	Lyngen I.	Metres	Metres	C°			
156	27	Abreast of Ski-		10	1.1	19.20	34.74	33.87
157		botten.		20	1.1	19.20	34.74	33.87
158				30	1.1	19.20	34.74	33.87
159				50	1.1	19.20	34.74	33.87
160				80	1.1	19.20	34.74	33.87
161				100	1.1	19.20	34.74	33.87
162				118	1.1	19.20	34.74	33.87
163		Lyngen II.	250	0	3.0	19.17	34.68	33.82
164		63°37′ N.,		10	3.1	19.20	34.74	33.87
165		20°24′ E.		20	3.1	19.20	34.74	33.87
166		Off the Kaafjord.		30	3.0	19.24	34.80	33.94
167				50	2.6	19.32	34.95	34.08
168				80	2.5	19.20	34.74	33.87
169				100	2.5	19.20	34.74	33.87
170				150	2.2	19.17	34.68	33.82
171				180	1.9	19.17	34.68	33.82
172				200	1.7	19.17	34.68	33.82
173				250	1.6	19.17	34.68	33.82
174		Lyngen III.		0	1.8	18.47	33.41	32.60
175		69°45.5 N.,		10	3.2	19.09	34.54	33.68
176		20°22′ E.		30	3.4	19.20	34.74	33.87
177		Abreast of Spokenes.		50	3.4	19.20	34.74	33.87
178				80	3.4	19.20	34.74	33.87
179				100	3.4	19.24	34.80	33.94
180				150	3.4	19.24	34.80	33.94
181				200	2.9	19.24	34.80	33.94
182	29	Malangen.	350	0	2.8	19.23	34.79	33.92
183		Between Lysbotn		10	2.9	19.23	34.79	33.92
184		and Stonnesbotn.		20	2.9	19.23	34.79	33.92
185				30	2.9	19.23	34.79	33.92
186				50	2.9	19.23	34.79	33.92
187				80	2.9	19.23	34.79	33.92
188				100	2.9	19.23	34.79	33.92
189				120	3.0	19.26	34.84	33.97
190				150	3.2	19.26	34.84	33.97
191				180	3.9	19.33	34.97	34.10
192				200	4.1	19.33	34.97	34.10
193				250	5.5	19.58	35.41	34.52
194				300	5.5	19.58	35.41	34.52
195				350	5.5	19.58	35.41	34.52
196	31	Hola.	150	0	2.1	18.84	34.09	33.25
197		Svolvær, Lofoten.		10	2.5	18.84	34.09	33.25
198				20	2.5	18.84	34.09	33.25
199				30	2.6	18.84	34.09	33.25
200				40	2.7	18.84	34.09	33.25
201				50	3.3	18.91	34.22	33.37
202				60	3.9	18.95	34.30	33.44
203				80	5.2	19.11	34.57	33.72
204				100	6.4	19.39	35.07	34.20
205				120	6.7	19.54	34.34	34.45
206				150	6.8	19.62	35.48	34.59
207		Lilandsbugten.		0	2.2	18.80	34.01	33.18
208		Østnesfjord.		10	2.2	18.84	34.09	33.25
209				20	2.4	18.84	34.09	33.25
210				30	3.3	18.91	34.22	33.37
211				40	3.4	18.91	34.22	33.37
212				46	3.5	18.95	34.30	33.44
213				55	4.7	19.10	34.56	33.70
214		Følstad.	120	0	2.5	18.84	34.09	33.25
215		Østnesfjord.		10	2.7	18.84	34.09	33.25
216				20	2.8	18.84	34.09	33.25
217				30	3.4	18.95	34.30	33.44
218				40	4.0	18.99	34.36	33.50
219				50	4.3	19.03	34.44	33.58
220				60	4.6	19.07	34.50	33.65
221				80	5.5	19.23	34.79	33.92
222				100	6.5	19.50	35.27	34.38
223				120	6.7	19.58	35.41	34.52
224		Helle.	140	0	2.1	18.84	34.09	33.25
225		Østnesfjord.		10	2.2	18.72	33.87	33.04
226				20	2.3	18.80	34.01	33.18
227				30	2.5	18.80	34.01	33.18
228				40	2.7	18.80	34.01	33.18
229				50	3.75	18.95	34.30	33.44
230				60	4.3	19.03	34.44	33.58
231				80	5.4	19.09	34.54	33.68
232				100	6.4	19.32	34.95	34.08
233				120	6.7	19.54	35.34	34.45
234				140	6.7	19.62	35.48	34.59
235	February 1	Henningsvær.	100	10	3.4	18.98	34.34	33.49

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	February	Henningsvær.	Metres	Metres				
236	1	8 miles StW of H.		30	3.6	18.98	34.34	33.49
237				50	3.6	18.91	34.22	33.37
238				60	3.6	18.98	34.34	33.49
239				80	5.3	19.13	34.60	33.74
240				100	6.2	19.32	34.95	34.08
241		Skroven.	300	0	3.3	18.94	34.27	33.42
242		4 miles S of		50	3.4	18.98	34.34	33.49
243		Skroven.		100	5.6	19.24	34.81	33.94
244				200	6.9	19.88	35.95	35.03
245				300	6.4	19.88	35.95	35.03
246	3	Raftsund I.	40	0	2.9	18.87	34.14	33.30
247		Abreast of the		10	3.1	18.87	34.14	33.30
248		Troldfjord.		20	3.3	18.91	34.22	33.37
249				30	3.4	18.94	34.27	33.42
250				40	3.4	18.94	34.27	33.42
251		Raftsund II.	270	0	2.7	18.91	34.22	33.37
252		Between Aarstenen		20	2.9	18.91	34.22	33.37
253		and Ulvaag.		50	2.9	18.99	34.36	33.50
254				80	4.0	19.05	34.46	33.61
255				100	6.2	19.51	35.28	34.40
256				150	6.5	19.65	35.54	34.64
257				200	6.5	19.69	35.60	34.70
258				250	6.6	19.69	35.60	34.70
259	4	Skroven.	380	0	3.0	19.02	34.42	33.56
260		5 miles OSO of S.		50	3.3	19.02	34.42	33.56
261				80	3.5	19.02	34.42	33.56
262				90	4.8	19.17	34.18	33.82
263				100	6.4	19.43	35.14	34.26
264				150	7.1	19.80	35.80	34.89
265				200	7.0	19.95	36.07	35.14
266				250	6.9	19.95	36.07	35.14
267				300	6.4	19.95	36.07	35.14
268				375	6.3	19.95	36.07	35.14
269	6	Tranødybet.	630	0	2.5	18.99	34.36	33.50
270		68°15.5 N.,		20	2.7	18.99	34.36	33.50
271		15°49′ E.		50	2.8	18.99	34.36	33.50
272		Between Lødingen		80	4.6	19.13	34.60	33.74
273		and Trane.		100	5.5	19.36	35.02	34.15
274				150	6.5	19.80	35.80	34.89
275				200	6.4	19.88	35.95	35.03
276				250	6.4	19.88	35.95	35.03
277				300	6.3	19.95	36.07	35.14
278				400	6.3	19.95	36.07	35.14
279				500	6.3	19.95	36.07	35.14
280				600	6.3	19.95	36.07	35.14
281				630	6.3			
282	7	Ofoten I.	360	0	1.7	18.87	34.14	33.30
283		Between Havnes		20	1.9	18.87	34.14	33.30
284		and Ramsund.		50	1.9	18.87	34.14	33.30
285				80	3.6	19.02	34.42	33.56
286				100	5.7	19.32	34.95	34.08
287				120	6.2	19.61	35.47	34.57
288				150	6.4	19.73	35.68	34.77
289				200	6.3	19.84	35.87	34.96
290				250	6.3	19.84	35.87	34.96
291				300	6.3	19.88	35.95	35.03
292				350	6.3	19.88	35.95	35.03
293		Ofoten II.	258	0	1.5	18.87	34.14	33.30
294		Between Bogen		20	1.8	18.87	34.14	33.30
295		and Ballangen.		50	1.8	18.87	34.14	33.30
296				80	1.9	18.91	34.22	33.37
297				100	5.4	19.40	35.09	34.21
298				120	6.2	19.65	35.54	34.64
299				150	6.2	19.73	35.68	34.77
300				200	6.2	19.80	35.80	34.89
301				250	6.2	19.84	35.87	34.96
302	8	Rombaken I.	40	0	0.2	18.80	34.01	33.18
303		At the head of R.		10	0.2	18.84	34.09	33.25
304				20	0.3	18.84	34.09	33.25
305				30	0.4	18.84	34.09	33.25
306				40	0.5	18.84	34.09	33.25
307		Rombaken II.	110	0	0.2	18.84	34.09	33.25
308		Abreast of ytre		20	0.5	18.84	34.09	33.25
309		Sildvik.		50	0.7	18.84	34.09	33.25
310				80	0.7	18.84	34.09	33.25
311				110	0.6	18.91	34.22	33.37
312		Rombaken III.	310	0	1.4	18.87	34.14	33.30
313		Inside Øijord.		20	1.4	18.87	34.14	33.30
314				50	1.4	18.87	34.14	33.30
315				80	1.4	18.87	34.14	33.30
316				100	4.8	19.28	34.88	34.01

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	February	Rombaken III.	Metres	Metres	C⁰			
317	8			120	6.0	19.54	35.34	34.45
318				150	6.0	19.69	35.60	34.70
319				200	6.0	19.69	35.60	34.70
320				250	6.0	19.76	35.73	34.82
321				300	6.0	19.76	35.73	34 82
322	9	Skjomen I.	40	0	1.9	18.91	34.22	33.37
323		At Elvegaard.		20	1.9	18.84	34.09	33.25
324				40	2.0	18.94	34.27	33.42
325		Skjomen II.	150	0	1.8	18.99	34.36	33.50
326		Abreast of Rontind.		20	1.8	18.91	34.22	33.37
327				50	1.8	18.91	34.22	33.37
328				100	1.7	18.91	34.22	33.37
329				150	1.7	18.94	34.27	33.42
330		At Frostisen. At the head of the Skjomenfjord.		0	1.7	18.94	34.27	33.42
331		Ofotenfjord. Abreast of Skarstad.		550	6.3	19.95	36.07	35.14
332	13	Strømmen I.	80	0	2.2	19.02	34 42	33.56
333		At Henningsvær.		20	2.3	18.94	34.27	33.42
334				50	3.3	18.94	34.27	33.42
335				80	3.4	19.13	34.60	33.74
336		Strømmen II.	35	0	1.7	19.02	34.42	33.56
337				20	1.7	18.94	34.27	33.42
338				30	1.75	18.94	34.27	33.42
339		Skroven.	248	0	2.1	19.05	34.46	33.61
340		5 miles SWtS of S.		20	2.9	19.02	34.42	33.56
341				50	3.0	19.02	34.42	33.56
342				80	3.1	19.05	34.46	33.61
343				90	3.8	19.13	34.60	33.74
344				100	5.4	19.35	35.00	34.13
345				110	6.4	19.51	35.28	34.40
346				120	6.85	19.69	35.60	34.70
347				150	6.8	19.83	35.85	34.94
348				200	6.7	19.91	36.00	35.08
349				240	6.6	19.91	36.00	35.08
350		Brettesnes—Skroven. Between Brettesnes and Skroven.		410	6.3	19.91	36.00	35.08
351	17	Oxsund.	630	0	1.1	18.83	34.07	33.23
352		68°1' N.,		20	1.8	18.86	34.13	33.28
353		15°18'.5 E.		50	2.7	18.97	34.32	33.48
354		Between Hammerø		80	5.4	19.29	34.90	34.02
355		and Lundø.		100	6.4	19.38	35.06	34.19
356				150	6.9	19.72	35.66	34.75
357				200	6.8	19.83	35.85	34.94
358				250	6.6	19.83	35.85	34 94
359				300	6.6	19.91	36.00	35.08
360				400	6.4	19.91	36.00	35.08
361				500	6.3	19.91	36.00	35.08
362				630	6.3	19 91	36.00	35 08
363		Sagfjord I.	210	0	2.7	18.97	34.32	33.48
364		At Furrunesvæggen.		10	3.1	19.00	34.38	33.52
365				20	3.9	19.08	34.52	33.66
366				50	6.1	19.37	35.04	34.16
367				100	6.85	19.58	35.42	34.52
368				200	6.4	19.80	35.80	34.89
369	21	Henningsvær I.	85	0	2.6	19.00	34.38	33.52
370		4 miles SSW of H.		20	2.6	19.00	34.38	33.52
371				50	3.2	19.12	34.59	33.73
372				85	4.2	19.29	34.90	34.02
373		Henningsvær II.	98	0	2.6	19.00	34.38	33.52
374		6 miles SSW of H.		20	2.6	19.00	34 38	33.52
375				60	3.0	19.08	34.52	33.66
376				90	3.9	19.26	34.84	33.97
377		Henningsvær III.	260	0	2.6	19.00	34.38	33.52
378		16 miles SSW of H.		20	2.9	19.08	34.52	33.66
379				50	4.0	19.26	34.84	33 97
380				80	5.3	19.44	35.16	34.28
381				100	6.9	19.62	35.48	34.59
382				120	7.0	19.69	35.60	34 70
383				150	6.9	19.80	35.80	34.89
384				200	6.7	19.88	35.95	35.03
385				250	6.6	19.88	35.95	35.03
386	22	Mortsund I. SO of Mortsund.	230	220	6.6	19.88	35.95	35.03
387	23	Reine I.	180	0	2.7	19.04	34.45	33.59
388		12 miles OtS of R.		20	2.7	19.04	34.45	33.59
389				50	4.1	19.29	34.90	34.02
390				80	5.0	19.58	35.42	34.52
391				100	5.2	19.51	35.28	34.40
	February	Reine I.	Metres	Metres	C⁰			
392	23			120	6.5	19.69	35.60	34.70
293				150	6.2	19.91	36.00	35.08
394				180	6.2	19.91	36.00	35.08
395		Reine II.	130	0	3.0	19.12	34.59	33.73
396		8 miles OtS of R.		20	3.1	19.12	34.59	33.73
397				50	4.5	19.29	34.90	34.02
398				80	5.0	19.44	35.16	34.28
399				100	5.6	19.51	35.23	34.40
400				120	6.8	19.72	35.66	34.75
401		Reine III.	85	0	2.7	19.04	34.45	33.59
402		4 miles OtS of R.		20	3.7	19.19	34.72	33.85
403				50	4.5	19.33	34.97	34.10
404				85	6.1	19.55	35.36	34.47
	March							
405	1	Evenstad I.	157	0	3.9	19.31	34.93	34.06
406		7 miles SO of		20	3.9	19.31	34.93	34.06
407		Lofotodden.		50	4.3	19.40	35.09	34 21
408				80	4.5	19.47	35.22	34.34
409				100	5.55	19.62	35.47	34.58
410				120	5.8	19.65	35.53	34.64
411				150	5.6	19.69	35.60	34.70
412		Moskenstrømmen I.	204	0	2.8	19.16	34.66	33.80
413		10 miles SO of		20	3.4	19.20	34.74	33.87
414		Lofotodden.		50	3.4	19.20	34.74	33.87
415				80	3.9	19.35	35.00	34.13
416				100	4.5	19.43	35.15	34.26
417				120	4.7	19.47	35.22	34.34
418				150	5.0	19.51	35.28	34.40
419				200	6.6	19.85	35.89	34.97
420	3	Kirkfjord I.	108	0	2.0	18.79	34.00	33.16
421		Inside the Vorfjord.		20	2.5	18.90	34.18	33.35
422				50	2.6	18.97	34.33	33.48
423				100	2.7	18.97	34 33	33.48
424		Kirkfjord II.	50	0	1.5	18.67	33.78	32.95
425		In the middle of the Kirkfjord.		50	2.5	18.93	34.26	33.40
426	4	Reine I.	150	0	2.1	19.01	34.40	33.54
427		11 miles SO of R.		20	2.3	19.01	34.40	33.54
428				40	2.35	19.01	34.40	33.54
429				50	2.5	19.05	34.47	33.61
430				60	3.4	19.13	34.60	33.76
431				70	5.1	19.35	35.00	34.13
432				80	5.9	19.43	35.15	34.26
433				100	6.5	19.58	35.41	34.52
434				120	6.6	19.62	35.48	34.59
435				150	6.7	19.69	35.60	34.70
436	5	Ure I.	230	0	2.6			
437		9½ miles SSO of U.		20	2.7	19.13	34.60	33.76
438				50	2.7	19.13	34.60	33.76
439				80	2.8	19.13	34.60	33.76
440				100	4.0	19.24	34.80	33.94
441				120	5.2	19.43	35.15	34.26
442				150	6.7	19.65	35.53	34.64
443				200	6.8	19.85	35.89	34.97
444	6	Henningsvær I.	142	0	2.1	19.01	34 40	33.54
445		6 miles SWtW½W		20	2.0	19.01	34.40	33.54
446		of H.		50	2.1	19.01	34.40	33.54
447				80	3.1	19.13	34.60	33.76
448				100	5.4	19.39	35.07	34.20
449				120	5.4	19.39	35.07	34.20
450				140	6.2	19.58	35.41	34.52
451		Henningsvær II.	110	0	1.7	18.97	34.32	33.48
452		5 miles SWtW of H.		50	2.1	19.01	34.40	33 54
453				80	2.5	19.04	34.45	33.59
454				100	5.1	19.39	35.07	34.20
455	10	Risværflaket.	175	0	1.2	18.82	34.05	33 21
456		Outside the Ogs-		20	1.25	18.90	34.20	33.35
457		fjord.		50	1.3	18.90	34.20	33.35
458				80	1.3	18.90	34.20	33.35
459				100	1.4	18.93	34 26	33.40
460				150	1.5	18.93	34.26	33.40
461				170	1.6	18.93	34.26	33.40
462		Flaket II. Nearer to the mouth of the Ogsfjord.	225	220	1.7	18.93	34.26	33.40
463		Brettesnes I.	177	0	1.7	19.01	34.40	33.54
464		2¼ miles SO¼O		20	1.8	19.01	34.40	33.54
465		of B.		50	1.9	19.01	34.40	33.54
466				100	2.7	19.13	34 60	33.76
467				120	4.9	19.35	35.00	34.13
468				150	6.7	19.65	35.53	34.64

Nr.	1899 Dato	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	March		Metres	Metres	C⁰			
469	10	Brettesnes I.		170	6.7	19.77	35.75	34.87
470		Brettesnes II.	180	0	1.5	18.97	34.32	33.48
471		1 mile NtO$^1/_2$O		20	1.8	18.97	34.32	33.48
472		of B. I.		50	1.9	19.01	34.40	33.54
473				80	2.4	19.13	34.60	33.76
474				100	2 6	19.16	34.66	33.80
575				120	4.0	19.31	34.93	34.06
476				140	6.3	19.58	35.41	34.52
477				150	6.8	19.73	35.68	34.77
478				180	6.7	19.80	35.80	34.89
479		Raftsund I.	48	0	2.3	18 82	34.05	33.21
480		Off the Troldfjord.		20	2.4	18.97	34.32	33.48
481				45	3.1	19.04	34.45	33.59
482	11	Kanstadfjord I.	30	0	1.6	18.79	34.00	33.16
483		At the head of K.		30	2.2	18.97	34.32	33.48
484		Kanstadfjord II.	84	0	1.7	18.86	34.13	33.28
485		Inside the Kvalø.		20	2.2	18.97	34.32	33.48
486				50	2.0	18.97	34.32	33.48
487				80	1.8	18.97	34.32	33.48
488		Kanstadfjord III. Inside the ridge.	94	90	1.6	18.97	34 32	33.48
489		Kanstadfjord IV.	95	20	1.4	18.90	34.20	33.35
490		Outside the ridge.		90	4.4	19.31	34.98	34.06
491	13	Høla.	150	0	1.3	18.97	34.32	33.48
492		Svolvær, Lofoten.		20	1.5	18.97	34.32	33.48
493				50	2.0	19.13	34.60	33.76
494				80	3.45	19.20	34.74	33.87
495				100	4.0	19.27	34.86	34.00
496				120	5.1	19.43	35.15	34.26
497				150	6.1	19.62	35.48	34.59
498		Henningsvær I.	100	0	1.5	19.04	34.45	33.59
499		5 miles SOtO$^1/_2$O		50	2.4	19.13	34.60	33.76
500		of H.		100	3.2	19.31	34.93	34.06
501		Henningsvær II.	250	0	1.8	19.04	34.45	33.59
502		6 miles StO$^1/_2$O		20	2.2	19.13	34.60	33.76
503		of H.		50	2.6	19.13	34.60	33.76
504				80	3.7	19.35	35.00	34.13
505				100	5.3	19.51	35.28	34.40
506				120	5.9	19.58	35.41	34.52
507				150	6.7	19.73	35.68	34.77
508				200	6.8	19.88	35.95	35.03
509				250	6.7	19.96	36.09	35.16
510	14	Risvær I. At Risvær in East Lofoten.		60	2.0	19.04	34.45	33.59
511		Risvær II.	250	100	4.6	19.39	35.07	34.20
512				150	6.1	19.65	35.53	34.64
513				200	6.6	19.80	35.80	34.89
514		Risvær III.		50	2.8	19.16	34.66	33.80
515				85	4.7	19.48	35.15	34.26
516		Paulsgrunden.	125	20	1.6	18.96	34.31	33.46
517		Fishingplace at		50	1.8	18.96	34.31	33.46
518		Risvær.		80	2.7			
519				100	3.4	19.22	34.77	33.91
520				110	4 8	19.32	34.95	34.08
521				120	5.6	19.55	35.36	34.47
522		Øgsfjord I.		0	2.1	18.43	33.34	32.54
523		At the head of the		20	2.2	18.72	33.87	33.04
524		fjord.		50	2.1	18.75	33.92	33.10
525				100	2.1	18.75	33.92	33.10
526		Øgsfjord II.	207	0	1.8	18.67	33.78	32.95
527		At Halvarsø.		20	1.6	18.86	34.13	33.28
528				50	1.7	18.89	34.18	33.33
529				100	1.5	18.89	34.18	33.33
530				150	1.4	18.89	34.18	33.33
531				200	1.4	18.89	34.18	33.33
532	16	Tranødybet.	640	0	1.5	19.08	34.44	33.58
533		Between Tranø and		20	1.6	19.00	34 38	33.58
534		Lødingen.		60	3.0	19.18	34.70	33.84
535				80	4.2	19.29	34.90	34.03
536				100	4.2	19.29	34.90	34.03
537				150	6.5	19.72	35.66	34.75
538				200	6.4	19.83	35.86	34.94
539				250	6.5	19.90	35.99	35.06
540				300	6.5	19.90	35.99	35.06
541				500	6.3	19.90	35.99	35.06
542				607	6.3	19.90	35.99	35.06
543				640	6.3	19.90	35.99	35.06
544	18			0	1.4	18.93	34.25	33.41
545				20	1.5	19.00	34.38	33.58
546				50	3.0	19.18	34.70	33.84
	March	Tranødybet.	Metres	Metres	C⁰			
547	18			100	5.0	19.47	35.22	34.84
548				150	6.2	19.72	35.66	34 75
549				200	6.5	19.87	35.92	35.00
550				500	6.5	19.87	35.92	35.00
551	20	Høla.	150	0	1.0	18.96	34.31	33.46
552		At Svolvær.		20	1.2	19.00	34.38	33.53
553				50	1.3	19.08	34.44	33.58
554				80	4.0	19.29	34.90	34.03
555				100	4.5	19.36	35.02	34.14
556				120	5.2	19.51	35.28	34.40
557				150	6.5	19.77	35.75	34.84
558		Balstad.		95	4.3	19.44	35.17	34.29
559		Balstad I.	180	0	2.0	19.18	34.70	23.84
560		10$^1/_2$ miles SSO		20	2.1	19.11	34.57	33.72
561		of B.		50	2.6	19.22	34.77	33 91
562				80	3.1	19.39	35.07	34.20
563				100	3.4	19.32	34.95	34 08
564				120	5.15	19.47	35.22	34.34
565				150	6.3	19.69	35.60	34.70
566				180	6.7	19.69	35.60	34.70
567		Balstad II.	130	0	2.0	19.15	34.65	33.79
568		6$^1/_2$ miles SSO of B.		20	2.0	19.15	34.65	33.79
569				50	2.1	19.15	34.65	33.77
570				80	3.0	19.25	34.82	33.96
571				100	3.95	19.39	35.07	34.20
572				130	5.75	19.58	35.41	34.52
573		Balstad III.		75	3.5	19.22	34.77	33.91
574		Henningsvær I.	105	0	1.5	19.08	34.52	33.67
575		3$^1/_2$ miles StO of H.		20	1.5	19.08	34.52	33.67
576				50	1.5	19.08	34.52	33.67
577				80	2.0	19.08	34.52	33.67
578				105	4.8	19.39	35.07	34 20
579		Henningsvær II.	280	0	1.7	19.08	34.52	33.67
580		6 miles StO$^1/_2$O		20	2.0	19.04	34.45	33.59
581		of H.		50	1.8	19.08	34.52	33.67
582				80	2.5	19.37	35.04	34.17
583				100	3.9	19.44	35.17	34.29
584				120	5.5	19.51	35.28	34 40
585				150	6.5	19.72	35.66	34.75
586				180	6.8	19.79	35.78	34.87
587				200	6.8	19.82	38.84	34.92
588				250	6.6	19.87	35.92	35.00
589				280	6.55	19.90	35.98	35.06
590	21	Moskenstrømmen. 5 miles SOtS of Lofotodden.	100	100	6.5	19.72	35.66	34.75
591		Reine I.	105	0	2.5	19.19	34.72	33.86
592		5 miles SOtS of R.		20	2.65	19.22	34.77	33.91
593				50	2.80	19.22	34.77	33.91
594				80	2.95	19.22	34.77	33.91
595				105	5.00	19.51	35.28	34.40
596		Værø.	175	0	3.2	19.33	34.97	34.10
597		7 miles StW of		20	3.25	19.33	34.97	34.10
598		Maahornet.		50	3.3	19.33	34.97	34.10
599				80	4.3	19.48	35.14	34 26
600				100	5.1	19.58	35.41	34.52
601				120	5.65	19.65	35.53	34.64
602				150	6.7	19.83	35.85	34.94
603				170	6.8	19.90	35.98	35.06
604	22	Røsthavet.	930	0	5.05	19.87	35.92	35.00
505		68⁰3′ N.,		20	5.2	19 87	35.92	35.00
606		10⁰0′.5 E.		50	6.0	19.92	36.01	35.09
607				80	6.4	20.01	36.18	35.24
608				100	6.4	20.05	36.25	35.51
609				120	6.4	20.05	36.25	35.31
610				150	6.3	20.05	36.25	35.31
611				200	6.15	20.05	36.25	35.31
612				250	5.8	20.05	36.25	35 31
613				300	5.6	20.05	36.25	35.31
614				400	5.4	20.05	36.25	35.31
615				500	4.05	19.94	36.05	35.18
616				600	2.5	19.94	36.05	35.13
617				700	1.3	19.87	35.92	35.00
618				900	1.1	19.87	35.92	35.00
619		20 miles NW of Røst.		0	3.7	19.51	35.28	34.40
620		30 miles NW of		100	5.6	19.72	35.66	34.75
621		Røst.		195	6.4	19.97	36.10	35.18
622		40 miles NW of Røst.		0	4.4	19.68	35.59	34.69
623	24	Røst I.	120	0	3.1	19.52	35.30	34.42

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	March	Røst I.	Metres	Metres	C°			
624	24	Outside Røst.		20	3.15	19.52	35.30	34.42
625				50	3.05	19.52	35.30	34.42
626				80	3.05	19.52	35.30	34.42
627				100	3.5	19.55	35.36	34.47
628				120	4.25	19.63	35.50	34.60
629		Røst II.	105	0	2.9	19.55	35.36	34.47
630		Outside Røst		20	3.35	19.55	35.36	34.47
631				50	4.4	19.67	35.57	34.67
632				80	4.5	19.67	35.57	34.67
633				100	4.85	19.74	35.70	34.79
634	25	Røst I.	136	0	2.9	19.44	35.16	34 28
635		Inside Røst.		20	2.8	19.44	35.16	34.28
636				50	3.4	19.52	35.30	34.42
637				80	3.5	19.52	35.30	34.42
638				100	3.8			
639				120	3.8	19.55	35.36	34 47
640		Røst II.	150	0	2.5	19.74	35.70	34.79
641		Inside Røst.		50	4.05	19.55	35.36	34.47
642				100	5.6	19.74	35 70	34.79
643				120	6.6	19.85	35.90	34.97
644				150	6.7	19.93	36.04	35.11
645	27	Risvær.	45	45	2.8	19.33	34.97	34.10
646		Gulvik.	100	0	0.9	19.03	34.44	33.58
647				20	1.2	19.11	34.57	33.72
648				50	2.5	19.22	34.77	33.91
649				80	5.4	19.55	35.36	34 47
650				100	6.1	19 74	35.70	34.79
651	28	Tysfjord I.	725	0	0.75	19.03	34.44	33.58
652		68°12′.5 N.,		50	2.3	19.15	34.65	33.79
653		16°12′.5 E.		90	4.4	19.44	35.16	34.28
654		Inside Skarberget.		100	5.5	19.59	35.43	34.54
655				120	6.4	19.67	35.57	34.67
656				150	6.4	19.81	35.82	34.91
657				200	6.3	19.85	35.90	34.97
658				250	6.3	19.85	35.90	34.97
659				300	6.3	19.93	36.04	35.11
660				400	6.3	19.93	36.04	35.11
661				500	6.3	19.93	36.04	35.11
662				600	6.3	19.93	36.04	35.11
663				700	6.3	19.93	36.04	35.11
664	29	Tysfjord II.	409	0	1.55	19.07	34 50	33.65
665		Inside Tysfjord		50	1.4	19.11	34.57	33.72
666		church.		80	5.2	19 48	35.24	34.35
667				100	5.75	19.59	35.43	34.54
668				120	6.1	19.67	35.57	34.67
669				150	6.2	19.74	35.70	34.79
670				200	6.2	19.81	35.81	34.90
671				250	6.3	19.85	35.90	34.98
672				400	6.3	19.93	36.03	35.11
	April							
673	1	Gulvik.		100	5.3	19.59	35.43	34.53
674				190	6.5	19 81	35.81	34 90
675	4	Lilandsbugten.	58	0	0.4	18.86	34.13	33.28
676		Østnesfjorden.		20	1.1	19.07	34.50	33.65
677				58	3.4	19.33	34.97	34.10
678		Brettesnes I.	77	0	1.05	19 03	34.44	33.58
679		Inside Moldøra.		20	1.1	19.07	34.50	33.65
680				50	2.5	19.22	34.77	33.91
681				77	4.7	19.48	35.23	34.35
682		Brettesnes II.	145	0	1.1	19.07	34 50	33.65
683				20	1.1	19.07	34.50	33.65
684				50	2.9	19.26	34.84	33.97
685				80	4.75	19.48	35.23	34.35
686				100	6.2	19.70	35.62	34.72
687				140	6 5	19.81	35.81	34.90
688		Følstad.	77	0	÷0.4	18.88	34.16	33.32
689		Østnesfjorden.		20	0.25	19.07	34.50	33.65
690				50	2.9	19.22	34.77	33 91
691				77	4.9	19.48	35.23	34.35
692		Helle.	118	0	0.5	19.86	34.13	33.28
693		Østnesfjorden.		20	1.0	19.07	34.50	33.65
694				50	2.9	19.26	34.84	33.97
695				80	5.0	19.48	35.23	34.35
696				118	5.7	19.63	35.50	34.60
697		Skroven.	190	0	1.1	19.11	34.57	33.72
698		At the edge inside S.		50	2.2	19.18	34.70	33.84
699				80	4.9	19 48	35.23	34.53
700				100	5.3	19.59	35.43	34.53
701				120	6.2	19.74	35.70	34.79
702				180	6.7	19.89	35.96	35.04
703		Høla.	150	0	0.8	19.11	34.57	33.72

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	April	Høla.	Metres	Metres	C°			
704	4	At Svolvær.		20	1.0	19.03	34.44	33.58
705				50	1.05	19.15	34.65	33.78
706				80	4.1	19.41	35.10	34.23
707				100	5.6	19.63	35.50	34.60
708				120	5.9	19.74	35.70	34.79
709				150	6.4	19.85	35.89	34.97
710	6	Henningsvær I.	95	0	1.1	19.18	34.40	33.84
711		4½ miles SO of H.		20	1.1	19.18	34.40	33.84
712				50	1.1	19.18	34.40	33.84
713				70	1.4	19.18	34.40	33 84
714				80	1.7	19.18	34.40	33.84
715				93	2.55	19.33	34.96	34.10
716		Henningsvær II.	165	0	1.75	19.22	34.77	33.91
717		6 miles SO of H.		20	1.85	19.22	34.77	33.91
718				50	1.85	19.22	34.77	33.91
719				80	2.85	19.30	34.91	34.05
720				100	4.3	19.37	35.04	34.17
721				120	5.55	19.56	35.37	34.49
722				160	6.6	19.74	35.70	34.79
723	7	Stene I.	85	0	1.05	19.06	34.49	33.63
724		6½ miles StO of S.		20	1.3	19.10	34.56	33.70
725				50	1.5	19.14	34.63	33.77
726				80	1.65	19.14	34.63	33.77
727		Stene II.	194	0	1.95	19.21	34.75	33.89
728		9½ miles StO of S.		20	1.95	19.21	34.75	33.89
729				50	2.9	19.37	35.04	34.17
730				80	2.95	19.37	35.04	34.17
731				100	4.6	19.52	35.30	34.42
732				120	5.7	19.67	35.57	34.67
733				150	6.6	19.78	35.77	34.86
734				194	6.6	19.86	35.91	34.99
735		Reine.	110	0	2.0	19.21	34.75	33.89
736		6½ miles SSO		20	2.0	19.21	34.75	33.89
737		of R.		50	2.35	19.21	34.75	33.89
738				80	4.0	19.44	35.17	34 29
739				110	4.5	19.52	35.30	34.42
740		Moskenstrommen.	90	0	1.95	19.21	34.75	33.89
741		5 miles S of Lofot-		20	2.0	19.21	34.75	33.89
742		odden.		50	2.3	19.21	34.75	33.89
743				90	4.1	19.44	35.17	34.29
744	11	Off Gaukværo.		0	2.75	19.44	35.17	34.29
745		Gaukværo I.	40	0	2.6	19.37	35.04	34.17
746		68°41′ N.,		20	2.6			
747		14°2′ E.		40	3.7	19.48	35.23	34.35
748		Gaukværø II.		0	2.85	19.37	35.04	34.17
749		68°34′ N.,		20	2.65	19.37	35.04	34.17
750		14°17′ E.		50	2.7	19.37	35.04	34.17
751				80	3.2	19.44	35.17	34.29
752				100	4.0	19.56	35.37	34.49
753				120	4.4	19.63	35.50	34.60
754				150	4.6	19.71	35.64	34.74
755				200	5.05	19.74	35.70	34.79
756				250	5.2	19.78	35.77	34.86
757	12	Malangen.	380	0	1.6	19.25	34.82	33.96
758		69°33′ N.,		20	1.75	19.33	34.96	34.10
759		18°0′ E.		50	1.6	19.33	34.96	34.10
760		Off Stønnesbotn.		80	1.85	19.40	35.09	34.21
761				100	2.15	19.48	35.23	34.35
762				120	2.3	19.48	35.23	34.35
763				150	3.25	19.56	35.37	34.49
764				200	3.7	19.59	35.43	34.54
765				250	4.05	19.67	35.57	34 67
766				300	4.01	19.67	35.57	34.67
767				380	4.1	19.67	35.57	34.67
768	13	Senjenhavet.	80	0	3.35	19.63	35.50	34.60
769		69°40′ N.,		20	3.45	19.63	35.50	34.60
770		16°47′ E.		50	5.1	19.85	35.90	34.97
771				80	5.3	19.85	35.90	34.97
772		Nearer land.		0	2.6	19.56	35.37	34.49
		69°38′ N.,						
		17°9′ E.						
773	14	Malangen.	382	0	1.7	19.37	35.04	34.17
774		Off Stønnesbotn.		10	1.65	19.37	35.04	34.17
775				20	1.7	19.37	35.04	34.17
776				30	1.7	19.37	35.04	34.17
777				40	1.75	19.40	35.09	34.21
778				50	1.8	19.40	35.09	34.21
779				80	2.15	19.44	35.17	34.29
780				100	2.4	19.48	35.23	34.35
781				120	2.7	19.48	35.33	34.35
782				350	4.1	19.67	35.57	34.67

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	April		Metres	Metres	C°			
783	19	Kvænangen I.	167	0	0.75	19.40	35.09	34.21
784		Between Spilderen		20	0.75	19.40	35.09	34.21
785		and Kvænangs-		50	0.75	19.40	35.09	34.21
786		tinderne.		80	0.75	19.40	35.09	34.21
787				100	0.75	19.40	35.09	34.21
788				120	0.75	19.40	35.09	34.21
789				160	2.0	19.56	35.37	34.49
790		Kvænangen II.	90	0	1.0	19.44	35.17	34.29
791		At Nøklen island.		20	0.75	19.40	35.09	34.21
792				50	0.75	19.40	35.09	34.21
793				90	0.75	19.40	35.09	34.21
794	20	Jøkelfjord I.	110	0	0.85	19.40	35.09	34.21
795		At the head of the		20	0.85	19.40	35.09	34.21
796		fjord.		50	0.85	19.40	35.09	34.21
797				80	0.90	19.44	35.17	34.29
798				100	1.00	19.44	35.17	34.29
799	21	Jøkelfjord III.	95	0	0.80	19.44	35.17	34.29
800		Off the Tverfjord.		20	0.75	19.44	35.17	34.29
801				50	0.90	19.44	35.17	34.29
802				90	1.4	19.48	35.23	34.35
803		Kvænangen.	343	0	1.05	19.48	35.23	34.35
804		70°2'.5 N.,		20	0.8	19.48	35.23	34.35
805		21°41' E.		50	0.8	19.44	35.17	34.29
806		Between Spilderen		100	1.2	19.48	35.23	34.35
807		and the northern		150	1.45	19.48	35.23	34.35
808		mainland.		200	1.95	19.63	35.50	34.60
809				250	2.2	19.56	35.37	34.49
810				340	2.3	19.56	35.37	34.49
811	24	Ingøhavet.	315	0	3.2	19.78	35.77	34.86
812		71°10' N.,		10	3.15	19.82	35.84	34.93
813		23°10' E.		20	3.10	19.82	35.84	34.93
814				30	3.3	19.86	35.91	34.99
815				50	3.65	19.90	35.98	35.06
816				70	3.65	19.93	36.04	35.12
817				80	3.8	19.93	36.04	35.12
818				100	3.8	19.97	36.10	35.18
819				120	3.65	20.01	36.17	35.24
820				150	3.55	20.01	36.17	35.24
821				200	3.5	20.01	36.17	35.24
822				250	3.45	20.01	36.17	35.24
823				300	3.45	20.01	36.17	35.24
824		Ingøhavet II.		0	2.75	19.67	35.57	34.67
825		Between Ingø and		20	2.80	19.67	35.57	34.67
826		the preceding		50	3.25	19.74	35.70	34.79
827		station.		100	3.8	19.86	35.91	34.99
828				200	3.8	19.97	36.10	35.18
829		Havet III.		0	2.0	19.63	35.50	34.60
		3 miles off Ingø.						
830		Breisund.	100	0	1.7	19.59	35.43	34.54
831		Between Hjelmesø		50	1.65	19.59	35.43	34.54
832		and Havø.		100	1.7	19.59	35.43	34.54
833	27	Porsangerfjord.	200	0	1.05	19.63	35.50	34.60
834		Between Great and		20	1.05	19.63	35.50	34.60
835		Litle Tamsø.		50	1.0	19.67	35.57	34.67
836				80	1.0	19.67	35.57	34.67
837				100	0.95	19.63	35.50	34.60
838				120	0.95	19.63	35.50	34.60
839				150	0.75	19.67	35.57	34.67
840				200	0.20	19.56	35.57	34.48
841	28	Porsangerfjord.	275	0	2.25	19.59	35.43	34.54
842		70°58'.5 N.,		20	2.25	19.59	35.43	34.54
843		26°25' E.		50	2.15	19.59	35.43	34.54
844		Off Sværholt-		100	1.4	19.55	35.36	34.47
845		klubben.		200	1.3	19.59	35.43	34.54
846				250	2.75	19.73	35.68	34.78
	May							
847	1	Vardø.	225	0	2.0	19.70	35.62	34.72
848		70°24'.5 N.,		20	1.9	19.66	35.55	34.65
849		31°28' E.		50	1.95	19.66	35.55	34.65
850				80	1.95	19.66	35.55	34.65
851				100	1.95	19.66	35.55	34.65
852				150	2.25	19.66	35.55	34.65
853				200	2.25	19.66	35.55	34.65
854		Vardø II.	183	0	1.9	19.66	35.55	34.65
855				180	2.05	19.66	35.55	34.65
856		Vardø III.		0	1.45	19.63	35.50	34.60
		Close up to						
		Vardø.						
857		Nordkyn.	58	0	1.9	19.63	35.50	34.60
858		71°8' N.,		20	2.05	19.63	35.50	34.60
859		27°42' E.		50	2.05	19.63	35.50	34.60

Nr.	1899 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	Mai		Metres	Metres	C°			
860	2	Silden.		0	1.55	19.41	35.10	34.24
		At Silden Island.						
861	3	Lyngen I.	120	0	1.7	19.37	35.04	34.17
862		Off Skibotten.		20	1.9	19.41	35.10	34.24
863				50	1.9	19.41	35.10	34.24
864				80	2.1	19.45	35.18	34.30
865				100	2.3	19.45	35.18	34.30
866				120	2.55	19.48	35.23	34.35
867		Lyngen II.	250	0	1.1	19.37	35.04	34.17
868		Off the Kaafjord.		20	1.1	19.37	35.04	34.17
869				50	1.15	19.37	35.04	34.17
870				80	2.05	19.45	35.18	34.30
871				100	2.2	19.48	35.23	34.35
872				150	2.55	19.48	35.23	34.35
873				200	2.7	19.55	35.36	34.47
874				250	2.85	19.55	35.36	34.47
875		Lyngen III.	320	0	1.35	19.37	35.04	34.17
876		69°54' N.,		20	1.25	19.37	35.04	34.17
877		20°27' E.		50	1.7	19.45	35.18	34.30
878		Between ytre Gam-		80	2.15	19.48	35.23	34.35
879		vik and Ulø.		100	3.05	19.55	35.36	34.47
880				120	3.25	19.59	35.43	34.54
881				150	3.45	19.66	35.55	34.65
882				200	3.3	19.66	35.55	34.65
883				250	3.5	19.73	35.68	34.78
884				320	3.65	19.77	35.75	34.84
885	5	Høla.	150	0	2.65	19.12	34.59	33.73
886		At Svolvær.		10	2.55	19.12	34.59	33.73
887				20	1.9	19.12	34.59	33.73
888				30	2.45	19.23	34.79	33.92
889				50	4.5	19.45	35.18	34.30
890				80	5.35	19.66	35.55	34.65
891				100	5.5	19.66	35.55	34.65
892				120	5.8	19.73	35.68	34.78
893				150	6.15	19.77	35.75	34.84
	1900							
	March							
894	20	Høla.	150	0	2.85	19.28	34.88	34.02
895				10	2.85	19.35	35.01	34.04
896				20	2.9	19.35	35.01	34.04
897				50	2.95	19.35	35.01	34.04
898				80	3.4	19.43	35.15	34.28
899				100	4.05	19.44	35.17	34.29
900				120	4.6	19.51	35.30	34.41
901				150	5.4	19.65	35.55	34.65
902		Skroven.	400	0	2.75	19.35	35.01	34.14
903		1 mile SSO of S.		20	2.80	19.35	35.01	34.14
904				50	2.85	19.39	35.08	34.21
905				80	3.15	19.39	35.08	34.21
906				100	4.55	19.54	35.35	34.47
907				120	5.10	19.65	35.55	34.65
908				150	6.10	19.80	35.82	34.91
909				200	6.5	19.88	35.96	35.05
910				250	6.5	19.94	36.07	35.15
911				300	6.5	19.94	36.07	35.15
912				400	6.35	19.94	36.07	35.15
913		Henningsvær.	270	0	2.85	19.35	35.01	34.14
914		6 3/4 miles SSO of H.		20	2.85	19.35	35.01	34.14
915				50	2.9	19.35	35.01	34.14
916				80	3.0	19.37	35.04	34.17
917				100	3.15	19.41	35.12	34.24
918				120	3.7	19.49	35.26	34.38
919				135	5.40	19.65	35.55	34.65
920				150	6.10	19.76	35.75	34.84
921				200	6.6	19.80	35.82	34.91
922		Henningsvær II.	165	0	2.7	19.29	34.90	34.04
923		2 3/4 miles of H.		20	2.8	19.30	34.92	34.05
924				50	2.9	19.31	34.94	34.06
925				100	2.95	19.33	34.97	34.11
926				120	4.0	19.56	35.39	34.50
927				150	6.25	19.81	35.84	34.93
928				165	6.95	19.81	35.94	34.93
929	21	Strømmen.	65	0	2.8			
930		Between Hennings-		20	2.7	19.35	34.97	34.11
931		vær and Valberg.		60	2.7	19.36	35.03	34.16
932		Balstad I.	212	0	3.05	19.33	34.97	34.11
933		3 miles of B.		20	2.9	19.36	35.08	34.16
934				50	2.9	19.39	35.08	34.21
935				80	5.35	19.47	35.22	34.35
936				88	5.65	19.47	35.22	34.35

Nr.	1900 Date	Locality	Soundings	Depth from which sample was obtained	Temperature of the water at that depth	Saline contents Cl. per litre	Salt per litre	Salt per mille
	March		Metres	Metres	C°			
987	21	Balstad I.		100	6.2	19.69	35.62	34 72
988				120	6.2)	19.70	35.64	34.74
939				150	6.6	19.82	35.68	34.94
940				180	6.6	19.96	36.11	35.18
941				200	6.6	19.96	36.11	35.18
942		Balstad II.	110	0	2.95	19.32	34.95	34.09
943				20	2.8	19.34	34.99	34.12
944				50	2.8	19.39	35.08	34.21
945				80	3.45	19.39	35.08	34.21
946				100	3.1	19.32	34.95	34.09
947		Balstad III.		0	2.95	19.32	34.95	34.09
948				50	2.80	19.32	34.95	34.09
949				70	2.85	19.32	34.95	34.09
950				80	3.85	19.36	35.03	34.16
951				100	2.85	19.36	35.03	34.16
952		Nufsfjord.	125	0	3.05	19.29	34.90	34.04
953		$6\frac{1}{2}$ miles SSO of N.		50	2.95	19.29	34.90	34.04
954				80	2.95	19.32	34.95	34.09
955				100	2.95	19.39	35.08	34.21
956				120	3.0			
957		Reine.	112	0	2.95	19.32	34.95	34.09
958				50	2.85	19.32	34.95	34.09
959				80	2.85	19.32	34 95	34.09
960				100	4.2	19.39	35.08	34.21
961	22	Tranødybet.	620	0	2.7	19.32	34.95	34 09
962		Between Tranø and		50	2.75	19.32	34.95	34.09
963		Lødingen.		80	2.75	19.32	34.95	34.00
964				100	2.7	19.32	34.95	34.09
965				120	2.65	19.32	34.95	34 09
966				150	2.7	19.32	34.95	34.09
967				180	2.8	19.52	35.31	34.43
968				190	6.25	19.75	35.78	34.83
969				200	5.5	19.75	35.73	34.83
970				250	6.25	19.75	35.78	34.83
971				400	6.3	19.91	36.02	35.10
972				500	6.3	19.91	36.02	35.10
973				600	6.3	19.91	36.02	35.10
974		Øgsfjord.	195	0	2.05	19.22	34.77	33.92
975		At the mouth.		20	2.2	19.24	34.81	33.95
976				50	2.3	19.24	34.81	33.95
977				80	2.35	19.24	34.81	33.95
978				100	2.35	19.24	34.81	33.95
979				150	2.4	19.24	34.81	33.95
980				190	2.6	19.27	34.86	34.00
981	23	Østnesfjord I.	27	0	2.1	19.22	34.77	33.92
982		At the head of the fjord.		20	2.35	19.24	34.81	33.95
983		Østnesfjord II.	135	0	2.3	19.22	34.77	33.92
984		Between Vaterfjord		20	2.3	19.22	34.77	33.92
985		and Følstad.		50	2 5	19.24	34 81	33.95
986				80	2.9	19.24	34.81	33.95
987				100	3.45	19 32	34.95	34.09
988				130	5.75	19.36	35.03	34.16
989		Østnesfjord III.	135	0	2.35	19.22	34.77	33 92
990		Abreast of Helle		20	2.45	19.22	34.77	33.92
991				50	2.6			
992				80	2.65	19.24	34.81	33.95
993				100	3.2	19.36	35 03	34.16
994				130	4.4			
995	26	Ørsnes.	105	0	2.8	19 39	35.08	34.21
996				50	2.8	19.39	35.08	34.21
997				80	2.8	19.39	35.08	34.21
998				100	4.7	19.50	35.28	34.39
999		Henningsvær.	160	0	2.7	19.32	34.95	34.09
1000				50	2.8	19.32	34.95	34.09
1001				80	2.8	19.40	35.01	34.23
1002				100	4.3	19.46	35.21	34.33
1003				140	4.65	19.54	35.35	34.45
1004		Balstad.	135	0	2.8	19.32	34.95	34.09
1005				50	2.8	19.32	34.95	34.09
1006				80	3.3	19.54	35.35	34.47
1007				100	4.5	19.57	35.40	34.52
1008				130	4.0	19.57	35.40	34.52
1009	27	Reine.	170	0	2.55	19.36	35.03	34.16
1010				50	2.8	19.40	35 01	34.23
1011				80	2.9	19.40	35.01	34.23
1012				100	4.6	19.54	35.35	34.47
1013				150	6.3	19.75	35.78	34.88
1014	30	Landego.	450	0	3.25	19.57	35.40	34.52
1015		67°22' N.,		50	3.95	19.50	35.27	34.39
1016		8°19' E.		100	3.65	19.54	35.35	34.47
1017				120	4.8	19.64	35.58	34.64
	March		Metres	Metres	C°			
1018	30	Landego.		150	5.3	19.66	35.57	34.67
1019				200	5.9	19.90	36.00	35.02
1020				260	6.0	19.90	36.00	35.08
1021				300	6.05	19.93	36.04	35.13
1022				400	6.2	19.93	36.04	35.13
1023				450	4.0?			
1024		Arnø. 67°11' N., 3°15' E.	410	400	6 55	19.96	36.11	35.18
	April							
1025	2	Skjerstadfjord II.	185	0	2.5	19.11	34 58	33.73
1026				50	3.25	19.18	34.70	33.85
1027				80	3.5	19.19	34.72	33.87
1028				100	3.5	19.21	34.75	33.90
1029				150	3.2	19.26	34.85	33.99
1030				185	3.35	19 26	34.85	33.99
1031		Skjerstadfjord IV.	330	250	3.2	19.29	34.90	34.04
1032				300	3.2	19.29	34.90	34.04
1033				330	3.15	19.29	34.90	34.04
1034		Skjerstadfjord V.	420	0	2.4	19.18	34.70	33.85
1035		Off Kvænflaaet.		20	2.45	19.18	34.70	33.85
1036				50	3.4	19.18	34.70	33.85
1037				80	3.55	19.21	34.76	33.90
1038				100	3.5	19.21	34.76	33.90
1039				150	3.3	19 26	34.85	33.99
1040				200	3.2	19.26	34.85	33.99
1041				250	3.2	19.27	34.86	34.00
1042				300	3.15	19.29	34.90	34.04
1043				400	3.15	19.32	34.95	34.09
1044		Skjerstadfjord III.	230	200	3.2	19.26	34.85	33.99
1045		Skjerstadfjord VII.	480	400	3.2	19.32	34.85	33.99
1046		Off Fauske.		475	3.15	19.32	34 85	33.99
1047	4	Skjerstadfjord XII.	515	0	2.3	19.11	34.58	33 73
1048		Off Skjerstad		20	2.7	19.11	34.58	33.73
1049		church.		50	3.45	19.18	34.70	33.85
1050				100	3.4	19.24	34.81	33.95
1051				150	3.3	19.26	34.85	33.99
1052				200	3.25	19.26	34.85	33.99
1053				300	3.2	19.29	34.95	34.04
1054				500	3.15	19.32	34.95	34.09
1055		Skjerstadfjord XIV.	400	400	3.05	19.32	34.95	34.09
1056	5	Saltenfjord II.	320	0	3.2	19.33	34.97	34.11
1057		67°14'.5 N.,		20	3.15	19.33	34.97	34.11
1058		14°26' E.		50	3.1	19.33	34.97	34.11
1059				60	3.6	19.54	35.35	34.47
1060				80	4.4	19.62	35.49	34.60
1061				100	5.0	19.73	35.69	34.79
1062				120	5.9	19.76	35.75	34.84
1063				150	6.2	19.82	35.86	34.94
1064				200	6.55	19.89	35 98	35.06
1065				250	6.65	19.93	36.05	35.13
1066				320	6.65	19.93	36.05	35.13
1067	6	Foldenfjord I.	530	0	3.2	19.33	34.97	34.11
1068		67°37' N.,		20	3.1	19.33	34.97	34.11
1069		15°2' E.		50	3.1	19.46	35.21	34.33
1070				80	4.2	19.46	35.21	34.33
1071				100	4.15	19.50	35.28	34.39
1072				120	5.55	19.78	35.78	34.88
1073				150	6.4	19.91	36.02	35.10
1074				200	6.6	19.78	35.78	34.88
1075				250	6.6	19.82	35.86	34.94
1076				300	6.6	19.82	35.86	34.94
1077				400	6.55	19 92	36.04	35.12
1078				500	6.55	19.85	35.91	35.00
1079	7	Vestfjord.	315	0	2.85	19.31	34.94	34.07
1080		Between Fladø and		20	2.8	19.33	34.97	34.11
1081		Skroven.		50	3.6	19.38	35.06	34.19
1082				60	4.55	19.60	35.46	34.57
1083				80	5.65	19.63	35.51	34.62
1084				100	6.4	19 63	35 51	34.62
1085				120	6.45	19.83	35 87	34.96
1086				150	6.45	19.85	35.91	35.00
1087				200	6.5	19 90	36.00	35.08
1088				250	6.5	19.90	36.00	35.08
1089				300	6.5	19.92	36.04	35.12
1090		Høla.	150	0	2.95	19.25	34.33	33.97
1091		At Svolvær.		10	2.55	19.25	34.33	33.97
1092				20	2.5	19.32	34.95	34.09
1093				50	2.5	19.34	34.99	34.12
1094				80	2.75	19.25	34.83	33.97
1095				100	3.95	19.51	35.30	34.41
1096				120	4.95	19.57	35.40	34.52
1097				150	5.85	19.78	35.80	34.88

B. Remarks on the Observations.

a. The Vest Fiord and the Coast Sea.

The observations, made in the Vest Fiord in January 1899, proved that at that time a comparatively high temperature prevailed on the surface of the water.

At Høla, near Svolvær, the surface temperature was 3°.3 C. on January 11th, halfway between Grøtø and Skroven 4.4 was registered on the surface and between Helligvær and Værø on the 13th of the month 4.6. About 4.0 was the surface temperature in Moskenstrømmen, and on the fishinggrounds beyond Reine, Stamsund and Henningsvær.

The highest degree which was registered in January, and in fact the highest surface temperature which was registered during the whole winter by this expedition was 5.9 ($^{19}/_{1}$) beyond Vesteraalen, 40 miles NNW of Gaukværø.

Further, as a result of the observations in the Vest Fiord, it is found that in the majority of places the maximum temperature is not reached at the bottom. At the station in the middle of the fiord between Grøtø and Skroven ($^{11}/_{1}$) the maximum (6.9) was at a depth of 100 meters.

At the station at Helligvær ($^{12}/_{1}$) the maximum (7.6) was reached at a depth og 140—150 meters, and at the station between Helligvær and Værø the maximum 7.2—7.6 at a depth af 120—150 meters.

In the Lofot fishingbanks too, there was a less clearly defined maximum, for instance at Stamsund ($^{17}/_{1}$) 6.9 at 120 m., and on the same day 6.7 at 120—150 m. at Henningsvær. On January 31st, the minimum at Høla was 2.5 on the surface, and the maximum 6.8 near the bottom at a depth of 150 meters. Corresponding conditions were noticed on the same day in the Østnes Fiord (Lilands Bay, Følstad, Helle).

Also at Skroven on February 4th the maximum (7.1) was found at a depth of 150 meters, the bottom temperature being 6.3 (380 m.). In the deep off Tranø the maximum ($^{6}/_{2}$) was reached about 150 m. down, the bottom temperature being 6.3 at 630 meters.

In Øxsund ($^{17}/_{2}$) the highest temperature (6.9) was at a depth of 150 meters, and here too the temperature at 630 meters was 6.8.

Here are some instances from the Lofot fishing banks: —

$^{21}/_{2}$. 16 miles SSW of Henningsvær.

Surface temperature 2.6, maximum 7.0 at depth of 120 mtrs., bottom temperature (260 mtrs.) 6.6.

$^{23}/_{2}$. 12 miles EtS of Reine.

Surface 2.7, max. (120 mtrs.) 6.5, bottom temp. 6.2.

Hence it may be gathered that in the months of January and February, the maximum temperature was to be found at a depth of 120—150 meters. Towards the end of February this maximum will be found near the bottom over large portions of the fishing banks.

Observations on the Lofot banks in March show minimum on the surface, and, as a rule, maximum near the bottom at a depth of 150—200 meters.

At greater depths in the fiords a less clearly defined maximum could at the same time be traced at a depth of 150—200 meters. Measurements taken in April show a continued cooling of the upper layers, with a surface temperature of 1—2 at Henningsvær, Stene and Reine.

The section beyond Ingø ($^{24}/_{4}$ 1899) 71° 10′ N. 23° 10′ E' showed minimum (3.2) on the surface, and maximum (3.8) at a depth of about 100 meters.

But on the other hand, from observations made off Nordkyn and Vardø ($^{1}/_{5}$) it was found that the temperature at these places was evenly disposed from the surface to the bottom.

On the first days of May there was no indication of any spring minimum, on the sea coast of Finmark nor in the Lyngen Fiord[1]). But when on May 5th I again took the temperatures at Høla near Svolvær the surface showed 2.65 and minimum (1.9) there had already reached a depth of 20 meters.

To give an idea of the changes in temperature and salinity in the course of the winter months, a table of observations made at Gaukværø off Vesteraalen is subjoined.

$^{18}/_{1}$ 1899	68° 35′ N.	14° 13′ E.	$^{11}/_{4}$ 1899	68° 34′ N.	14° 17′ E.
Depth in meters	Temperature C°.	Salinity ‰	Depth in meters	Temperature C°.	Salinity ‰
0	4.1	33.56	0	2.85	34.17
10	4.4	33.56	20	2.65	34.17
20	4.5	33.56	50	2.70	34.17
30	4.5	33.56	80	3.2	34.29
80	5.0	34.04	100	4.0	34.49
150	6.9	34.27	120	4.4	34.60
250	7.1	34.88	150	4.6	34.74
			200	5.05	34.79
			250	5.2	34.86

1) At Lyngen III (cf. no. 875—884) there is, however, a minimum at a depth of 20 m.

As the places at which these observations were made are so near each other that one may, without any fear of making any mistake worthy of the name, consider them as one and the same, it is made clear from this table that from January to April there is a considerable decrease in the temperature, but an increase in the salinity of the layers of water on the Northern coast banks. We see too that although at Vardø and Norkyn there was no indication of the spring minimum, yet on the sea coast off Vesteraalen the minimum (2.65) was reached at a depth of 20 meters as early as April 11th.

Here is a table of observations made on the coast sea off Senjen.

$^{21}/_{1}$ 1899. The Senjen Sea, 12 miles NWtW of Maanesodden			$^{13}/_{4}$ 1899. The Senjen Sea.		
Depth in meters	Temp. C⁰.	Salinity ⁰/₀₀	Depth in meters	Temp. C⁰.	Salinity ⁰/₀₀
0	3.3	33.13	0	3.35	34.60
10	3.9	33.13	20	3.45	34.60
20	3.9	33.13	50	5.1	34.97
40	3.9	33.13	80	5.3	34.97
50	4.3	33.13			
80	4.5	33.33			
100	4.6	33.33			
120	4.4	33.33			

The comparatively high temperatures and salinity on $^{13}/_{4}$ indicate that water from the south has displaced the water whose temperature and salinity on $^{21}/_{1}$ is mentioned above. That the layers of water on the banks of the northern coast are tolerable homogeneous in the winter, was also gathered from the observations of previous years.

Captain Bie on $^{15}/_{4}$ 1897 found the following conditions at a station situated west of Sørøen:

$^{15}/_{4}$ 1897. 70⁰ 45′ N., 20⁰ 30′ E.

Depth in meters	Temperature C⁰.	Salinity ⁰/₀₀
0	4.1	34.56
10	4.1	34.56
20	4.1	34.54
50	4.0	34.54
80	4.0	34.56
120	4.3	34.61

In February 1897 I measured off Vesteraalen:

$^{10}/_{2}$ 1897. 68⁰ 50′ N., 14⁰ 36′ E.

Depth in meters	Temperature C⁰.	Salinity ⁰/₀₀
0	3.0	33.87
50	4.2	33.92
100	4.35	33.92
150	4.35	33.92
170	4.35	33.92

When the salinity is as even as tabulated above, a fall in the surface temperature caused by the giving off of heat to the atmosphere is easily balanced by the vertical currents. So as to give a clear idea of the decrease of surface temperatures, I will now compare observations made in the deep off Tranø — The Vest Fiord — on Feb. 6th and March 16th 1899.

Tranødybet. 68⁰ 15′.5 N., 15⁰ 49′ E.

	$^{6}/_{2}$ 1899		$^{16}/_{3}$ 1899	
Depth in meters	Temp.	Salinity	Temp.	Salinity
0	2.5	33.50	1.5	33.58
20	2.7	33.50	1.6	33.53
50	2.8	33.50		
60			3.0	33.84
80	4.6	33.74	4.2	34.03
100	5.6	34.15	4.2	34.03
150	6.5	34.89	6.5	34.75
200	6.4	35.03	6.4	34.94
250	6.4	35.03	6.5	35.06
300	6.3	35.14	6.5	35.06
400	6.3	35.14		
500	6.3	35.14	6.3	35.06
600	6.3	35.14	6.3	35.06
630	6.3	35.14	6.3	35.06

It will be noticed that the fall in temperature has principally taken place in the upper 20 meters, which in the time mentioned became about 1⁰ colder.

The observations made along the Lofot fishing banks in March 1900 bear great resemblance to those in March of the year before.

Minimum (2—3) was found on the surface, and maximum at a depth of 150—200 meters.

This again proved that the maximum temperature is found at or near the bottom in the majority of the fishing banks.

Measurements at Høla near Svolvær and in the Vest Fiord, halfway between Skroven and Flado ($^{17}/_{4}$) proved that spring minimum was even then beginning to be evident.

The salinity of the waters which covered the Lofot banks in January 1899 was from 33—35 ⁰/₀₀. The titration of the samples taken in that month only rarely, however, show so high a salinity as 35. The complete series of observations made on $^{19}/_{1}$ on the sea off Vesteraalen (40 miles NNW of Gaukværø) did not even reach so high as 35 although samples were taken from the surface right down to a depth of 1000 meters. But as this is an isolated case, I will not give any particular weight to it.

During measurements in February, 35 ⁰/₀₀ was reached in some places, e. g.:—

$^{13}/_{2}$	1899, near Skroven	200 m.	35.08.
$^{17}/_{2}$	„ Oxsund	300 m.	35.08.
$^{21}/_{2}$	„ Henningsvær III	200 m.	35.03.
$^{23}/_{2}$	„ Reine I	150 m.	35.08.

It will be found too that measurements in the Vest Fiord in March showed a salinity of about 35 at a depth of 200 m. and the same holds good with regard to April. Neither was any exception to this rule discovered in the measurements in the Vest Fiord in March 1900.

If the salinity on different dates be compared, for instance that at Gaukværø (Gaukvær Island) on $^{18}/_{1}$ and $^{11}/_{4}$ 1899 and at Senjen on $^{21}/_{1}$ and $^{13}/_{4}$ it will at once be seen that a considerable increase has taken place.

So as to emphasize this fact still more, I will mention my observations at Høla near Svolvær.

Høla near Svolvær.

Depth in meters	$^{9}/_{4}$ 1896		$^{19}/_{2}$ 1897		$^{5}/_{3}$ 1897		$^{10}/_{3}$ 1897		$^{11}/_{1}$ 1899		$^{31}/_{1}$ 1899		$^{13}/_{3}$ 1899		$^{20}/_{3}$ 1899		$^{4}/_{4}$ 1899		$^{5}/_{5}$ 1899		$^{29}/_{3}$ 1900		$^{7}/_{4}$ 1900	
	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S	T	S
0	1.8	32.24	2.1	33.36	2.4		2.3	33.68	3.8	33.16	2.1	33.25	1.3	33.48	1.0	33.46	0.8	33.72	2.65	33.73	2.85	34.02	2.95	33.97
10	2.05	32.60					2.3	33.68	3.5	33.16	2.5	33.25							2.55	33.73	2.85	34.14	2.55	33.97
20	3.07	33.27							3.6	33.16	2.5	33.25	1.5	33.48	1.2	33.53	1.0	33.58	1.9	33.73	2.9	34.14	2.5	34.09
30	3.70	33.39					2.3		3.7	33.16	2.6	33.25							2.45	33.92				
40	3.93	33.58							3.7	33.10	2.7	33.25												
50			2.3	33.42	2.5	33.61	2.4	33.68	3.8	33.21	3.3	33.37	2.0	33.76	1.3	33.58	1.05	33.78	4.5	34.30	2.95	34.14	2.5	34.12
80									3.8	33.21	5.2	33.72	3.45	33.87	4.0	34.03	4.1	34.23	5.35	34.65	3.4	34.28	2.75	33.97
100	4.95	33.98	4.2	33.80	2.7	33.68	2.5	33.08	4.6	33.21	6.4	34.20	4.0	34.00	4.5	34.14	5.6	34.60	5.5	34.65	4.05	34.29	3.95	34.41
120			4.7	33.92							6.7	34.45	5.1	34.26	5.2	34.40	5.9	34.79	5.8	34.78	4.6	34.41	4.95	34.52
130					4.7	34.11	4.6	34.11	6.6	34.80														
150	5.93	34.29							6.6	34.52	6.8	34.59	6.1	34.69	6.5	34.84	6.4	34.97	6.15	34.84	5.4	34.65	5.85	34.88

From the above table it seems to be sufficiently clear that the salinity of the layers of water increases all through the months of January to April inclusive.

The reason for this is probably that the rainfall in the winter months is less than in the autumn. The fall which takes the form of snowis also at that time of year a factor which may be ignored. A good deal of influence on the salinity of the water in the winter, is probably to be found in the fact that much fresh water is imprisoned in the ice, which is formed in the smaller fiords and at the ends of the greater ones.

Generally speaking it may be affirmed that the surface temperature and the surface salinity decreases the further in one goes in the Vest Fiord, and the values are of course least at the ends of the branch fiords.

This will be made clear if one follows the results of the observations made. e. g. from Rombaken to Værø and Røst. With regard to the factors mentioned, it may be said that the continental and the oceanic powers oppose each other, and one would at once expect to find that the oceanic influence would be more strongly felt in proportion to distance from the ends of the fiords and *vice versa*.

While the temperature and salinity of the surface in the deep off Tranø (Tran Island) $^{16}/_{3}$ 1899 was 1.5 and 33.58, the corresponding figures at Værø were 3.2 and 34.10 on the 21st of the same month. And on the 22nd, there was found 35 pro mille water on the surface of the sea NW of Røst and a temperature of 5.05.

The observations made there are of considerable interest.

$^{22}/_{3}$ 1899. 68° 3′ N., 10°.05′ E.

Depth in meters	Temp. C°.	Salinity ‰
0	5.05	35.00
20	5.2	35.00
50	6.0	35.09
80	6.4	35.24
100	6.4	35.31
120	6.4	35.31
150	6.3	35.31
200	6.15	35.31
250	5.8	35.31
300	5.6	35.31
400	5.4	35.31
500	4.05	35.13
600	2.5	35.13
700	1.5	35.00
900	1.1	35.00

So that comparisons may be made, I also give Professor MOHN's observations made at a neighbouring station in June 1877.

$^{29}/_{6}$ 1877. 68° 3′ N., 9° 53′ E.

Depth in meters	Temperature C°.
0	8.2
91	7.1
183	6.2
366	5.3
549	3.5
732	— 0.5
914	— 1.1
1083	— 1.12

These observations are made with a MILEER-CSAELLA's deep water thermometer, while I used Professor PETTERSON's waterbottle, which although it is an excellent instrument can hardly be depended upon with respect to its isolating properties when the depths are as great as from 7 to 9 hundred meters.

The observations made on $^{22}/_{3}$ 1899 at any rate show that 35 pro mille water may off the banks of Lofot—Vesteraalen reach to a depth of at least 900 meters.

By comparing the measurements on the Røst Sea ($^{22}/_{3}$) with those in the Tys Fiord ($^{28}/_{3}$) very interesting results are obtained.

$^{28}/_{3}$ 1899. The Tys Fiord I.

Depth in meters	Temperature C°.	Salinity ‰
0	0.75	33.58
50	2.9	33.79
90	4.4	34.28
100	5.5	34.54
120	6.4	34.67
150	6.4	34.91
200	6.3	34.97
250	6.3	34.97
300	6.3	35.11
400	6.3	35.11
500	6.3	35.11
600	6.3	35.11
700	6.3	35.11

The temperature values in the upper layers show considerable decrease, while in the deep a great constancy prevails. But on the other hand, on the Røst Sea the upper layers show a comparatively high temperature.

At a depth of 120 meters, the temperature at both places was 6.4 but then there is a great difference between them. On the sea the temperature falls from 6.4 to 1.3 between 120 and 700 meters, but in the Tys Fiord at the same depths it only falls from 6.4 to 6.3.

What can be the reason of this extraordinary difference?

It will at once be noticed that the salinity of the different layers in the sea are pretty much the same, while a considerable difference is found in the Tys Fiord. At the former place, the cooling of the surface gives rise to vertical currents, which in their turn almost balance the difference in temperature.

In this way even a pretty deep layer of water may exchange heat with the atmosphere. But when the conditions are like those in the Tys Fiord, where the salinity in the upper layers is so varied, even a considerable decrease of surface temperature will not disturb the equilibrium of the water.

As now the distribution of heat through the water takes place slowly, the result must be that the surface itself decreases considerably in temperature, and that it is only a comparatively thin layer which exchanges heat with the atmosphere.

So as to get an idea of the extent of the changes which take place in the upper layers, let us examine H. H. Gran's observations made in the Tys Fiord in the summer of 1898[1]) (Hydrographical Tables s. XXVII).

$^{26}/_{7}$ 1898. 68° 15'.4 N., 16° 7'.3 E.
Korsnes in the Tys Fiord.

Depth in meters	Temperature C°.	Salinity ‰
0	13.6	30.71
10	11.5	33.05
20	9.18	33.48
30	7.08	33.62
40	6.05	33.84
50	5.5	33.89
70	5.4	34.20
100	5.4	

As Gran's station was close to the place where I made my observations (Tys Fiord I), the results may be compared.

We get the impression that the top layers are subject to great increase of temperature in summer and great decrease in winter, and wee see too that the temperature at a depth of 100 meters on the $^{26}/_{7}$ was 5.4 and 5.5 on the $^{28}/_{3}$.

It is wellknown that the natural conditions in the depths of the large fiords are firmly established. The water in the deep fiord basins is tolerably homogeneous, the temperature and salinity are almost unvarying throughout the whole mass, and there are only very slight differences in the course of a year. There are especially two things which control this.

In the first place, the topography of the bottom of the sea is of extreme importance, for, if for instance the deep part of the Tys Fiord was lengthened out towards the ocean, the probability is that conditions would then be somewhat different.

In the second place, the supply of continental fresh water, which by weakening the surface layers forms these into an isolating belt, is doubtless of great importance in connection with the stability of the conditions in the depths of the fiords.

There is certainly every reason to believe that there is a thicker layer on the sea which gives off heat to the atmosphere than in the fiords, but this does not, all the same, explain the great fall in temperature in the deep which takes place beyond the sea boundary.

One can scarcely think that this is kept up in any other way than by the flow of water from colder regions. There must be a cold undercurrent in the ocean.[1])

b. The Fiords.

In the winter of 1899, I had an opportunity of visiting several of the northern fiords, and as I was able to make two sets of observations in some of these, I am in a position to give results which make it possible to compare. I was however prevented from making observations in the same fiords during the following winter. But I had the pleasure of obtaining several observations in the Skjerstad Fiord, which presents many peculiarities on account of its considerable depth and its being so shut off from the sea.

In the following pages, some details will first be given of each of the fiords visited, then an attempt will be made to give a general characteristic, by help of which the similarities and dissimilarities in physical conditions will be made clear.

Sandhornö (ö-island) which is situated S. of Bodö on the south side of the Salten Fiord is separated from the mainland by two smaller fiords. Between Gildeskaal and Sandhornö we have Morsdal Fiord (also called S. Beier Fiord and Sund Fiord) and on the opposite side we have N. Beier Fiord. In these two small fiords dredgings were made $^{31}/_{3}$ 1900.

The farm Sund lies at the point of Gildeskaal peninsula. Here dredgings were made at a depth of 50—150 meters, and in the adjoining fiord just inside Kvarsnes at a depth of 50 meters. Neither of these fiords seemed to be very deep.

The Salten Fiord is the tolerably broad fiord arm which runs into the land near Bodö. The islands Strömö and Godö separate it from the Skjerstad Fiord, which farther in is also called the Saltdal Fiord. The Salten and the Skjerstad Fiord are connected by three comparatively shallow streams, of which the central one, the famous „Saltström" is a rival to the Moskenström in bulk and force. With regard to the depth of the Salten Fiord, two soundings are marked on the sea chart about half way between Sandhornö and the peninsula on which Bodö is situated, the one states a depth of 131 f. (246.60 m.) the other 112 f. (210.84 m.). A little further in, I sounded 380 meters but it was from a depth of 320 m. that the samples of water were taken (Saltenfiord II).

[1]) H. H. Gran. Hydrographical, Biological Studies of the North Atlantic Ocean and the Coast of Nordland. (Report on Norwegian Fishery and Marine Investigations. Vol. I. 1900. Nr. 5).

[1]) Cf. Mohn, the North Ocean, and Nansen, Some oceanographical Results of the Expedition with the „Michael Sars" in the Summer of 1900. N. Mag. f. Naturv. B. 39, H. 2. Kristiania 1901.

Thus it appears that the bed of the Salten Fiord, which has a maximum depth of at least 380 meters, slopes fairly evenly outwards, but somewhat steeply inwards; for at the outer end of Saltströmmen 40 m. was reached and at the inner 60 m.

It is said that in the most shallow part of the stream the depth is only about 20 meters.

Several soundings were taken in the Skjerstad Fiord, by means of which a very good idea of the depth can be formed.

If not otherwise specified, it may be taken for granted that the soundings were made in the middle of the fiord. At the end of the fiord (Skjerstad Fiord I) the bottom was reached at 30—50 m. About 1.5 miles out (S. II) the depth was 100—185. S. III and S. IV lie in the outer half of that part of the Skjerstad Fiord which runs southwards, and the depths here were respectively 230 and 330 meters.

Opposite Kvænflaaet (S. V.) I sounded at 420 m., and in the arm of the fiord close to Fauske (S. VI) at 100—150 m.; while the depth in the middle of the fiord opposite Fauske (S. VII, VIII) was 470—490 m. Just off the coast of Skjerstad in the direction of the Misvær Fiord the depth was 80—50 m. and at the mouth of the Misvær Fiord (S. X) 10—30 m., while a little further in the same fiord the depth was 50 m. (S. XI). On the other hand, the depth in the middle of the Skjerstad Fiord just opposite the church (S. XII) was 515 m.

A little further out (S. XIII) strangely enough it was only 110 m. deep, and from here the bed again sinks to the greatest depth sounded in the whole fiord, viz. 518 meters.

Then it again inclines evenly upwards, for at the following stations in the direction of Saltströmmen (S. XIV, S. XV, S. XVI) the respective depths were 400, 380, 330 m. Measurements taken in the middle of the fiord from the end to the inner part of Saltströmmen give the following figures: 30, 50, 100, 185, 230, 330, 420, 470, 490, 515, 110, 518, 400, 380, 330, 40 m.

How far the rise from 110 to 515 and 518 is an isolated point, or whether there is a ridge stretching across the fiord, I am not able with certainty to decide.

It will be seen from the foregoing that the Skjerstad Fiord is considerably deeper than the Salten Fiord, and that the greatest depth sounded in it up to the present time is 518 meters.

Observations in the Skjerstad Fiord gain increased interest as the Norwegian North Atlantic Expedition in 1877 had a couple of stations here.[1])

Temperature registrations are here given for the sake of comparison.

$^{15}/_8$ 1877. The Skjerstad Fiord.

Depth in meters.	Temp. C⁰.
0	13.0
481	3.23

[1]) H. Mohn: The Depths, Temperature and Circulation of the North Ocean, p. 53.

$^{17}/_8$ 1877. The Skjerstad Fiord.

Depth in meters.	Temperature C⁰.
0	11.4
18	8.7
37	7.8
55	7.5
73	6.7
91	5.7
110	5.0
128	4.0
146	3.2
165	3.1
183	3.0
201	3.2
219	3.1
238	3.3
457	3.4
494	3.2

Now I will compare this table with one from my series of observations.

$^{4}/_{4}$1900. The Skjerstad Fiord XII.

Depth in meters.	Temperature C⁰.	Salinity ‰.
0	2.8	33.73
20	2.7	33.78
50	3.45	33.85
100	3.4	33.95
150	3.3	33.90
200	3.25	33.99
300	3.2	34.04
500	3.15	34.09

These last two tables resemble each other in so far as in both of them the physical conditions from a depth of 150 m. down are seen to be pretty much alike, and this can hardly be looked upon as due to chance.

The Skjerstad Fiord is a typical shut in basin, so that there can be no renewal of the water in its bottom from any undercurrent.

The temperature waves must come from above downwards, and according to what has already been mentioned one must be able to conclude that, e. g. the distribution of heat in the deep is in a high degree prevented by the mixing of fresh water with the surface layers. There are also signs which seem to indicate that the changes in degrees of heat take place exceedingly slowly in the water at considerable depths.

Reference has already been made to the conditions with regard to the maximum of temperature in the month of March in the Lofot Banks. But if one looks over the measurements in the Skjerstad Fiord in the beginning of April, it will be seen that even so late as that the maximum has not got very far.

Thus $^2/_4$ S. II. 80 m. 3.5 (max.)
$^2/_4$ S. V. 80 - 3.55 „

Judging from the figures just noted for $^4/_4$ S. XII, it may also be concluded that the maximum lies between 50 and 100 m. But this again shows that the changes in temperature take place very slowly. In the Salten Fiord, where the ocean water has free access, there was no sign of the maximum at a depth of 80 m., the autumn maximum had entirely disappeared and the highest temperature was reached at the bottom at a depth of 320 m.

See the following table.

$^5/_4$ 1900. The Salten Fiord II.

Depth in meters.	Temperatur C⁰.	Salinity ⁰/₀₀.
0	3.2	34.11
20	3.15	34.11
50	3.1	34.11
60	3.6	34.47
80	4.4	34.60
100	5.0	34.79
120	5.9	34.84
150	6.2	34.94
200	6.65	35.06
250	6.65	35.13
320	6.65	35.13

If the above table be compared to that of the section S. XII ($^4/_4$), a striking difference will at once be noticed. Not only is the bottom temperature in the Salten Fiord much higher than in the Skjerstad Fiord (3⁰.5 difference) but the salinity on the surface of the former is even a little higher than at the depth of 500 m. in S. XII. That such decided differences in the hydrographical conditions of the Salten and Skjerstad Fiords, as shown by temperature and salinity, also cause biological differences, is a foregone conclusion. This subject will be dealt with further on in this treatise.

From the Folden Fiord, I have only one sounding ($^6/_4$ 1900 Foldenfj. I) taken halfway between Hjertö and the south mainland. The depth was 530 meters. From the high temperature and salinity of the water from the bottom (*Vide* no. 1067—1078) one may conclude that the ocean water is not prevented from flowing into, at any rate, the outer part of the fiord. It should be added that there is another Norwegian fiord which bears the name of the Folden Fiord, it is in the county of North Trondhjem, just south of the 65th degree of latitude. In the old days, the Kristiania Fiord also used to be known by this name.

The Öx Sound and the Sag Fiord.

One of the entrances to the Sag Fiord from the Vest Fiord is formed by the Öx Sound (between Hammerö and Lundö).

While in the sea chart for that part of the Vest Fiord which is beyond the Öx Sound the depth is given as 211—252 fathoms (897.21—474.38 m.) we took in the Öx Sound the following depths from the mouth inwards: 455, 450, 630, 620, 620 meters. So that this short, narrow sound (the length is about 5 miles, and the breadth about 1 mile) has a maximum depth of 630 meters. I believe this is the one single case in the whole of Norway.

Respecting temperature and salinity, attention is drawn to the tables (nr. 351—362).

It will be seen that it is especially from the upper 20 meters that the accumulation of the summer heat is given off to the atmosphere. It may probably also be stated as a fact that the less salt surface layers serve as an isolating belt, by means of which the loss of heat from the layers beneath is to a great extent prevented.

In the Sag Fiord proper, only a couple of soundings were taken in the inner end outside Furrunes (Sagfj. I, II). The depths here were respectively 210 and 315 m. From the high temperature and salinity of the water at the bottom (*Vide* nr. 363—368) I conclude that this inner part of the fiord is not shut off by any ridge from the rest of it.

The innermost parts of the Vest Fiord and of the Tys Fiord are very interesting on account of their great depths. The greatest depth in the Vest Fiord is found north of Tranö, for the sake of brevity I refer to this as the Tranö deep (Tranödybet). On the old sea charts soundings are not marked beyond a line Kjeö—Tranö, but I have taken many soundings from here, from which it is made clear that the great fall of 5—600 m. and more continues almost up to Barö.

Halfway between Barö and Rotvær 280 m. were sounded, from here in the direction of Tranö the following depths were noted: 324, 570, 608, 610, 630, 620, 535. In a straight line across the fiord from Offersö in the direction of Tiltvigtind the following were sounded: 250, 630, 680, 640 m. and from Offersö to the mouth of the Tys Fiord: 485, 580, 585, 320, 465 m. Thus it will be seen that there is a rise directly outside the mouth of the Tys Fiord.

After this rise there is again a fall in the bed of the Tys Fiord, for soundings taken in a straight line from the centre of the mouth of the Tys Fiord to the inner half of Skarberget gave the following figures: 615, 630, 615, 725, 725 m. This great depth is almost without variation right up to Skarberg.

As far as I know, 725 m. is the greatest depth reached in any fiord north of Trondhjem, and I take the liberty of calling the great basin which stretches from Korsnes to Skarberg, the Tysfiord deep. The innermost boundary for this basin I am unable to give precisely; the last sounding at 725 m. was taken a little further in than Skarberg, and here dredgings were made and samples of plankton and water taken (Tysfiord I).

A sounding between Ulvö and the Northern mainland gave a depth of 230 m., while the depth at the station Tysfiord II, which is a little further in than Tysfiord church, was 409.

A little further in, in the same arm of the fiord, the bottom was reached at 130 and 140 m. respectively.

That there is no high submarine ridge between Tys Fiord church and the mouth of the fiord, may be seen by comparing the observations made at the two stations (*Vide* nrs. 651—672). The observations made in the basins of the Tys Fiord and Tranö show a great similarity. There is reason to believe that the bottom temperature at the places mentioned remains for years at 6—7, with a salinity of about 35. The animal and plant existences in the basins, thus live in physical conditions of remarkable constancy.

The Vest Fiord is continued in the Ofot Fiord, which again has several important arms. Of these, the Skjomen Fiord and the Rombak Fiord were visited in 1899.

There is a rise in the bed a little west of Barö, which is again succeeded by a fall towards the Ofot Fiord. Between Barö and Tjelodden 545 m. were reached, and opposite Skarstad 550. Then there is a rise; for opposite Havnes the depth was 360 (Ofoten I, $^7/_2$ 1899) and between Bogen—Ballangen (Ofoten II, $^7/_2$ 1900) 258 m. There are considerable depths also in the Rombak

Fiord a little further in than Öijord 310 m. was sounded (Rombaken III, $^{8}/_{2}$ 1899). Furthest in at Rombakbotnen the depth was only 40 m. (Rombaken I) and opposite outer Sildvig 110 m. (Rombaken II, *Vide* nrs. 302—311). At the station Skjomen I at the end of the Skjomen Fiord near Elvegaard the depth was also only 40 m. (nrs. 322—324).

In the middle part of this fiord (Skjomen II) the depth however was 150 m. (nrs. 325—329) and the same depth was sounded just a little further in than the mouth, while a sounding taken in the mouth proper gave only 85. Moreover, judging from the figures giving the temperature and salinity at the station Skjomen I and II, it may be concluded that this fiord is shut off by a submarine ridge from any flow of warm, salt ocean water.

Thus we have

$^{9}/_{2}$ 1899. Skjomen II.

Depth in meters.	Temperature C⁰.	Salinity ⁰/₀₀.
0	1.8	33.50
20	1.8	33.37
50	1.8	33.37
100	1.7	33.37
150	1.7	33.42

Generally there is ice on the Skjomen Fiord in the winter.

Similar physical conditions are found in Rombakbotnen, which is connected to the Rombak Fiord proper by a shallow stretch known as „Strömmen" (The current). On the other hand, observations in the outer Rombak Fiord (R. III, $^{8}/_{2}$ 1899, nrs. 312—321) show that the warm, salt ocean water has been able to get access to this place. From the measurements taken in February in 1897 and 1899 in the Ofot Fjord, it is made sufficiently clear that the surface layers of the fiord in question gave off much more heat than is the case in the Lofot fishing grounds, and the loss of heat is still greater in the smaller fiords which adjoin the Ofot Fiord.

The **Ögs Fiord** is shut off from the Vest Fiord by innumerable small islands and holms, but the **Kanstad Fiord** has a more direct connection with the principal fiord. When we visited the Kanstad Fiord on $^{11}/_{3}$ 1899 its inner part was covered with ice, our first station (K. I) thus being just beyond „Strömmen" which connects the inner and outer half. The depth here is only 30 m. Further in than Kvalö 84 m. was reached. Just beyond Kvalö outwards there is a rise in the bed which is called „the ridge" (revet). From this point onwards to just opposite Nes the following depths were reached: 46, 75, 95 m.

About halfway between Offersö and Barö the depth was found to be 215 meters.

On $^{11}/_{3}$ 1899 the temperature inside „the ridge" at a depth of 90 meters was 1.6 and the salinity 33.48; outside at the same depth the temperature 4.4 and the salinity 34.06. It may also be gathered from this that the outer part of the Kanstad Fiord is connected with the Vest fiord by an unbroken channel, while the ridge prevents the warmer bottom water from penetrating into the inner part of the fiord.

Outside the mouth of the Ögs Fiord, there is a stretch of water, which is nearly free for islands and holms, which is called „Flaket"; and here I have sounded from 175—220 meters. This comparatively open stretch of water continues towards Pundsletvaagon and Aarstenen.

Observations made on $^{10}/_{3}$ 1899 however (nrs. 455—463) give such low temperature and salinity that one must conclude that „Flaket" is pretty much shut off. At a depth of 220 m., for instance, the temperature was 1.7 and salinity only 33.40.

On the inner part of the Ögs Fiord there is ice in the winter. Station I ($^{14}/_{3}$ 1899) was just on the border of the ice. The depth here was 100 m.; temperature 2.1 from the surface to the bottom, but the salinity varied from 32.54—33.10 (nrs. 522—525). Station II ($^{14}/_{3}$ 1899) was situated near Halvorsö towards the mouth of the Ögs Fiord. The depth here was 207 m. As several observations were made here, I adjoin the various results for the sake of comparison.

$^{14}/_{3}$ 1899. The Ögs Fiord II.

Depth in meters.	Temperature C⁰.	Salinity ⁰/₀₀.
0	1.3	32.95
20	1.6	33.28
50	1.7	33.33
100	1.5	33.33
150	1.4	33.33
200	1.4	33.33

On $^{23}/_{2}$ 1897 I also had a station not far from Halvorsö[1] (Hydr. Tables p. 16).

Then the following results were obtained:

Depth in meters.	Temperature C⁰.	Salinity ⁰/₀₀.
0	1.4	33.25
10	2.1	33.49
50	2.3	33.40
100	2.6	33.61
145	2.7	33.61

At the same place on $^{23}/_{3}$ 1900 the following results were obtained:

Depth in meters.	Temperature C⁰.	Salinity ⁰/₀₀.
0	2.05	33.92
20	2.2	33.95
50	2.3	33.95
80	2.35	33.95
100	2.35	33.95
150	2.4	33.95
190	2.6	34.00

It will be seen from these observation tables that the hydrographical conditions in the Ögs Fiord vary in no small degree from year to year. One might almost be tempted to say that more of

[1]) Hjort, Gran and Nordgaard. Report on Norwegian Marine Investigations 1895—97. Bergen 1899.

the salter water flows in one year than another, which again one might account for, as the curve for 34 pro mille in the corresponding part of the Vest Fiord reached higher one year than the other. However nothing certain can be said on this point.

There is another fiord, the Östnes Fiord, which from the Vest Fiord goes into Östvaagö, and this fiord is of far more importance economically speaking than the two fiords just mentioned on Hinnö. In the Östnes Fiord there is often very good cod fishing.

The greatest depth which was measured in 1899 was 140 meters just opposite Helle in the outer part of the fiord. Respecting the hydrographical conditions refer to the tables nrs. 207—234, 981—994.

The Kirk Fiord stretches in to Moskenesö from the Vest Fiord. The greatest depth we measured on $^{3}/_{3}$ 1899, a little way from the mouth of the Vor Fiord inwards, was 130 meters. From 0—100 m. here the temperature rose from 2.0 to 2.7, while the salinity increased from 33.16 to 33.48.

At Station II in the inner half of the fiord the rise in temperature and salinity was respectively (from 0—50 m.) 1.5—2.5 and 32.95—33.40. *Vide* the tables nrs. 420—425. In the Vest Fiord at the same time (11 miles SE of Reine) the temperature at a depth of 100 m. was 6.5 and salinity 34.52.

In the Malang Fiord, I have only observations from the deepest part between Senjen and Kvalö. But I have two sets of observations taken on $^{29}/_{1}$ and $^{12}/_{4}$ 1899 respectively.

It is interesting to compare these, nrs. 182—195, 757—767).

In this fiord just as at several other places in the month of January, there was on $^{29}/_{1}$ a homogenous layer from the surface to a depth of 100 m. with a temperature of 2.9 and a salinity of 33.92. From 120—350 m. the temperature rose from 3.0 to 5.5 and salinity from 33.97 to 34.52. On $^{12}/_{4}$ the conditions were considerably altered. As one would expect, the cooling of the surface layers was still further advanced. The upper 50 m. had a temperature of 1.6, which is equal to more than one degree's fall.

There is nothing remarkable in this, but more unexpected was it to find that the temperature at a depth of 350 m. had fallen from 5.5 to 4.1.

Such a considerable change of temperature at such a great depth has not previously been observed in our fiords.

Neither can it be explained as the result of a cooling process, by which the layers of water have given off heat to the atmosphere. The most likely solution of this problem is that this change is occasioned by an undercurrent from the ocean. A hint in this direction is also given by the fact that the salinity was also somewhat higher.

Measurements in the Lyngen Fiord ($^{27}/_{1}$ and $^{3}/_{5}$ 1899) also furnish interesting examples of a considerable change in hydrographical conditions. With regard to the depths in this fiord it should be mentioned that we sounded 118—125 m. opposite Skibotten; 250 m. outside the mouth of the Kaa Fiord; 200 m. opposite Spokenes, and 320 m. between outer Gamvik and the north point of Ulö. Thus it appears that Lyngen, like the majority of the northern fiords, is deepest in the outer part.

Observations made on $^{27}/_{1}$ (nrs. 155—162) at station L. II show a remarkable uniformity from the surface to the bottom.

At the next station the state of things was still more remarkable (nrs. 163—173), as the temperature decreased from the surface downwards. This is exactly contrary to what is usual in the fiords in the winter, and I therefore call it the reversed winter state. At station L. III too, there was an indication of something similar, the temperature at a depth of 150 m. being 3.4 and at 200 m. 2.9 (nrs. 174—181). But on the other hand on $^{3}/_{5}$ the state of things in the same fiord was altogether different. On this date at station L. I there was an inequality, both in temperature and salinity (nrs. 861—866), and at st. L. II the usual winter state, with quite an even rise in the temperature from the surface downwards (nrs. 868—875). The same conditions were also found at st. L. III[1]) (nrs. 875—884). The question now arises how can the unusual distribution of heat which was found at st. L. II on $^{27}/_{1}$ (the reversed winter state) be explained. As, however, the case here mentioned is not an isolated one, I will not give my theory to explain it, until I have described the other similar cases. In the Kvænang Fiord we took soundings between Lökö and Brynilen at a depth of 150 m., between Spilderen and the south mainland at a depth of 180 m. Between Spilderen and the north mainland 343 m. was sounded, and it is probable that this is the greatest fall in the bed of the Kvænang Fiord. Further in the fiord near the island Nöklan the depth was only 90 m., and in the Jökel Fiord which joins the Kvænang on the north 110 m. were reached on the border of the ice right in at the end of the fiord close to the glacier. This depth was also reached just outside the Tver Fiord. Measurements on $^{24}/_{1}$ 1899 at K. I and II (nrs. 135—154) showed a remarkable uniformity in the temperature and salinity of the layers of water. This uniformity was also found on $^{19}/_{4}$. To verify this the values are compared in the following table. It should be noticed that K. I on $^{24}/_{1}$ = K. I on $^{19}/_{4}$.

Kvænangen 70° 1′ N., 21° 28′.5 E.
Between Spilderen and the southern mainland.

	$^{24}/_{1}$ 1899		$^{19}/_{4}$ 1899	
Depth in meters	Temp. C°	Salinity °/00	Temp. C°	Salinity °/00
0	2.6	33.87	0.75	34.21
10	2.6	33.87	0.75	34.21
20	2.6	33.87	0.75	34.21
30	2.6	33.87	0.75	34.21
50	2.6	33.87	0.75	34.21
80	2.6	33.87	0.75	34.21
100	2.6	33.87	0.75	34.21
120	2.6	33.87	0.75	34.21
150	2.8	33.87	0.75	34.21
160			2.0	34.40
180	3.1	33.87		

From this table it will be seen that from $^{24}/_{1}$ to the $^{19}/_{4}$ there was a cooling in the upper 120 m. of nearly 2°, and that during the same period the salinity increased.

The slight irregularity found in the observations on $^{21}/_{4}$ (nrs. 803—810) is probably to be accounted for by some process of mixing. On the other hand, the physical conditions in the Jökel Fiord are particularly uniform (nrs. 794—802) with a low temperature and a rather high salinity.

The depths in the Porsanger Fiord are well known, as it has been sounded long ago. According to the sea chart the maximum depth 150 f. (282.37 m.) is reached in the mouth between Sværholtklubben and Helnes on Magerö. Hence and inwards to

[1]) L. III for $^{3}/_{5}$ did not correspond to L. III on $^{27}/_{1}$.

Store Tamsö the depth is about 200 m. or more. Depths of about 200 m. have also been sounded further in than the island mentioned; but the Porsanger Fiord on the whole may be said to be comparatively shallow.

According to dr. Hjort[1]) a remarkably low temperature ÷ 1°.15 C. was registered, at a depth of from 90—100 meters, in the summer of 1900, by the „Michael Sars“ expedition.

Further out in the fiord at a depth of 200 m. a temperature of 3°.6 C. was measured. When we visited the Porsanger Fiord at the end of April 1899, the whole of the inner part of the fiord was covered vith ice, but, as the observations made on ^{27}—$^{28}/_4$ (nrs. 833—846) show, a temperature so low as 0°.2 C. was taken between Store and Lille Tamsö at a depth of 200 m., and this is the lowest temperature which has ever been registered in any Norwegian fiord at such a great depth. And the temperature ÷ 1°.15 C., which was registered by the „Michael Sars“ expedition in the summer of 1900, is the lowest which has been found at all in any Norwegian fiord.

The temperatures noted in the Porsanger fiord give similar results to those already known from the Lyngen Fiord. There is a fall in temperature from the surface downwards (the reversed winter state).

At the mouth of the Porsanger Fiord on $^{28}/_4$ 1900 the following conditions were noted:

Depth in meters	Temp. C°	Salinity °/₀₀
0	2.25	34.54
20	2.25	34.54
50	2.15	34.54
100	1.4	34.47
150	1.4	34.54
200	1.3	34.54
250	2.75	34.78

From the surface down to 200 m. the salinity is fairly uniform, but the temperature falls from 2.25 to 1.3. On the other hand, along the bottom at a depth of 250 m. a flow of warmer and salter water has penetrated (2°.75 C. and 34.78 °/₀₀). Between Store and Lille Tamsö where observations were made on $^{27}/_4$ 1899 we noted the following:

Depth in meters	Temp. C°	Salinity °/₀₀
0	1.05	34.60
20	1.05	34.60
50	1.0	34.67
80	1.0	34.67
100	0.95	34.60
120	0.95	34.67
150	0.75	34.67
200	0.2	34.48

[1]) Cf. Hjort, Fiskeri og Hvalfangst. (Bergen 1902), p. 18 and H. Friele, Mollusken der ersten Nordmeerfahrt. (Bergens museums aarbog, 1902, p. 3).

There is reason to believe that the „reversed winter state“ describes conditions which are easily disturbed. It is true I had no opportunity of repeating the vertical section at any other places than those in the Lyngen Fiord, but there it was found that the usual winter conditions were again prevalent on the $^{8}/_{5}$. When giving oneself the task of judging concerning these peculiar conditions, it is helpful to remember that nothing corresponding has been noticed in the western fiords (vestlandske fjorde) where we have for several years taken measurements also in the winter. To settle the hydrographical conditions, in any single fiord for instance, several factors may have to be reckoned with. That the temperature of the atmosphere plays an important one, is clear, and by comparing the results obtained in the northern and southwestern fiords, as I have done, I have come to the conclusion that the fall of rain is a factor which must be considered.

From Mohn's rainfall-charts[1]) it will be seen that the fall is most uneven in the different parts of the country. Although there has of course been some slight variations in the fall in one and the same place from one year to another, yet on the whole it is seen that the distribution has been fairly uniform during the period that these measurements were made. It is another matter that there may possibly be something periodical in the distribution of the fall.

It may thus be stated that there is a greater fall in the western fiord districts than in the fiords of Tromsö and Finmark, and it is reasonable to suppose that this circumstance must have some influence both hydrographically and biologically speaking. I will now only allude to the hydrographical part of the subject.

One must expect in the Finmark fiords, where there is less fall, to be able to trace a rise in salinity, especially as so much falls in the form of snow so that it does not at once make its influence felt. Besides this, in the northern fiords large quantities of fresh water is retained in the layers of ice in the inner parts of the fiords. From these circumstances one might attempt to explain the greater average salinity of the surface layers of the northern fiords in winter as compared to the fiords in the west country (vestlandske fjorde).

On account of the slight flow of fresh water into such a fiord as the Kvænang, in the course of a winter a great uniformity in salinity may be established, and (*Vide* observations) just for this very reason the cooling of the atmosphere will exert a great influence on the cooling of the layers, the vertical current taking with it the water with its low temperature (which it has reached by being cooled by the atmosphere) from the surface downwards.

The observations made furnish sufficient proof that in the course of the winter a great levelling in temperature and salinity goes on, and there are instances of complete uniformity from the surface right down to the bottom. However, it is possible that these conditions may be disturbed by warmer coast water being driven into the fiord by the wind. And in such a case the „reversed winter state“ would be found, the original fiord water having cooled so much that it settles under the inflowing coast water, even if the latter is slightly salter. After all, this is only a parallel case to that in the „Nordhav“ (the North Ocean) where the warm salt ocean water from more southerly regions settles above the cold and less salt water which comes from the north.

[1]) Cf. Nedbøriagttagelser i Norge, Aarg. V, VI.

c. Hydrographical Characteristic of the Fiords of Northern Norway.

It is a well known feature in the western (vestlandske) fiords that the maximum depth is found in the inner parts, but several of the northern fiords are found to be different in this respect. It is true that the greatest depth (about 650 m.) in the Vest Fiord is further in than Tranö (Tranö-deep) and in the Varanger Fiord the greatest depth (424 m.) is just off the Bög Fiord (in the middle part of the fiord), but it may be stated that the maximal depth is found in the outer half of many of the fiords.

In the following table I have given a special name to the place where the greatest depth is found.

Fiord	Max. depth	Situation
Malang	Malangs deep 433 m.	Just opposite Stönnesbotn. 69°33′ N., 18°0′ E.
Lyngen	Gamvik deep 320 m.	Between outer Gamvik and Ulö. 69°54′ N., 20°27′ E.
Kvænang......	Kvænangs deep 343 m.	Between Spilderen and the northern mainland. 70°2′.5 N., 21°41′ E.
Porsanger	Porsanger deep 282 m.	Between Sværholt and Helnes. 70°58′.5 N., 26°25′ E.
Lakse	Sværholt deep 326 m.	A little inside the mouth. 70°56′ N., 26°53′.5 E.
Tana	Tana deep 318 m.	Just off the Ty Fiord. 70°50′ N., 28°36′ E.
Varanger......	Varanger deep 424 m.	Just off the Bög Fiord. 69°56′.5 N., 30°10′ E.

I owe the majority of the above data to the general charts of Geographical Survey. I have relied on my own measurements, which are on the whole not a large number, with regard to the Lyngen and Kvænang fiords.

A little beyond the mouth of the Salten Fiord inwards I have sounded 380 m.; but this depth is less than may be found in the Skjerstad Fiord which is still further in, I reached a depth of 518 m. a little outside Skjerstad church. It is quite remarkable in the district between the Skjerstad and the Ofot Fiords how many depressions there are, as will be seen from the following table.

Fiord	Depth	Situation
Skjerstad	Skjerstad deep 518 m.	A little beyond Skjerstad church.
Folden	Hjertö deep 580 m.	Between Hjertö and the southern mainland, 67°37′ N., 15°2′ E.
Öxsund	Öxsund deep 630 m.	Between Hammerö and Lundö. 68°1′ N., 15°18′.5 E.
Tys	Tysfiord deep 725 m.	A little inside Skarberg. 68°12′.5 N., 16°12′.5 E.
Ofot	Skarstad deep 550 m.	Just opposite Skarstad. 68°23′.5 N, 16°17′.5 E.

This series of greater depths lies between 67° and 68°30′ N. The powers which combine to form fiords must have been exercised in an unusually large degree in this district, and it is probably very difficult to find any parallel instance of such depths in such a limited area.

It will be found on careful consideration of the observations taken that a great many of the fiord deeps are very uniform with regard to temperature and salinity. So as to make this clear at a glance the following tabulated observations have been inserted.

Fiord	Locality	Date of observation	Soundings in m.	Depth measured m.	Temp. C°	Salinity ‰
Salten	67°14′.5 N. 14°26′ E.	5/4 1900	380	320	6.65	35.13
Folden	67°37′ 15°2′	6/4 1900	530	500	6.55	35.00
Öxsund	68°1′ 15°18′.5	17/2 1899	630	630	6.3	35.08
Tys	68°12′.5 16°12′.5	28/3 1899	725	700	6.3	35.11
Vest	68°15′.5 15°49′	6/2 1899	630	630	6.8	35.14
Ofot	68°23′.5 16°17′.5	9/2 1899	550	550	6.3	35.14

Observations made at different times of the year have proved that a considerable constancy in temperature and salinity prevails in these fiord deeps. Another set of fiords shall now come into consideration.

Fiord	Locality	Date of observation	Soundings m.	Depth measured m.	Temp. C°	Salinity ‰
Malang	69°33′ N. 18°0′ E.	20/1 1899	433	350	5.5	34.52
Lyngen	69°54′ 20°27′	3/5 1899	320	300	3.65	34.84
Kvænang....	70°2′.5 21°41′	21/4 1899	343	340	2.3	34.39

Fiord	Locality	Date of observation	Sounding m.	Depth measured m.	Temp. C°	Salinity ‰
Porsanger ...	70°58'.6 26°25'	28/4 1899	282	250	2.75	34.78
Tana[1]......	70°47' 28°30'	25/6 1878	232	232	2.8	
Varanger[2] ..	69°56'5 30°10'	Aug.1875	424	424	3.1	

A special characteristic of the places above mentioned is that the temperature was below 6° C. and the salinity less than 35 pro mille. There is also reason for supposing that these two factors are more subject to change here than in the fiords mentioned in the former table. For instance, in the Malang Fiord on 14/4 1899 the temperature was 4.1 and the salinity 34.67. There are also many smaller fiords, which show similar conditions. Instances of this are tabulated in the following list.

Fiord	Locality	Date of observation	Soundings m.	Depth measured m.	Temp. C°	Salinity ‰
Skjerstad....	S. XII	4/4 1900	515	500	3.15	34.09
Skjomen	S. II	9/2 1899	150	150	1.7	33.42
Kanstad.....	K. III	11/3 1899	94	90	1.6	33.48
Ögs	Ö. II	14/3 1899	207	200	1.4	33.33
Kirk........	K. I	3/3 1899	108	100	2.7	33.48

The fiords above mentioned are certainly connected with those which have a bottom temperature of 6°—7°, and a salinity of about 35 ‰, but submarine ridges prevent the warm bottom water from flowing in. The heat which the Gulf Stream brings with it does not exert any influence worth considering on the deeper layers of water in these fiords, and the condition of things in the depths is determined by the local meteorological factors in a special degree.

[1]) The North Atlantic Expedition, 1878.

[2]) Professor Mohn.

A few examples, showing the loss of heat caused where a fiord is shut off by a submarine ridge, will be of interest. On March 10th 1899 at a depth of 200 meters in the Ögs Fiord the temperature was 1.7 and the salinity 33.40 ‰. On the same day at the same depth in the Vest Fiord outside the temperature 6.7 and the salinity 34.87; there thus being a difference of 5° C. in temperature.

On April 4th 1900 at a depth of 200 meters in the Skjerstad Fiord, the temperature was 3°.25 C. and the salinity 33.99 ‰, while in the Salten Fiord the figures were respectively 6°.55 and 35.06; there thus being a difference of 3°.3 in temperature.

It is not to be wondered at that these differences evidence themselves in the distribution of fauna.

As a result of the observations and particulars detailed in the preceding pages it would seem reasonable and natural to divide the northern fiords into two groups[1]) as follows: —

1. Fiords in which the bottom temperature is 6°—7° C. with a salinity of about 35 ‰ in the water at the bottom.
   (Examples: The Salten, the Folden, the Tys, the Ofot and the Vest Fiord).
2. Fiords in which the bottom temperature is less than 6° C. and the salinity at the same depth is less than 35 ‰.
   (Examples: The Malang, Lyngen, Kvænang, Porsanger, Tana, Varanger, Skjerstad, Skjomen, Kanstad, Ögs and Kirk Fiords.)

The Malang Fiord is a kind of connecting link between the two groups. It must also be mentioned that the Skjerstad Fiord, for instance, belongs to the second group on account of its being shut off by a submarine ridge which prevents the inflow of the ocean water; while the Lyngen and Porsanger Fiords for instance, on the other hand, must classify under the second group on account of their being situated so far north that the ocean water has been considerably cooled and their salinity has been reduced by mixing with fresh water.

Later on we shall show that the distribution of fauna and its character in the two groups are so different, that the above classification of the fiords is justifiable also for that reason.

[1]) Cf. Nordgaard: Some Hydrographical Results. (Bergens museums aarbog 1899, p. 23).

II. PLANKTON.

NOTES.

In my plankton tables the marks have the following signification:

rr = very scarce,
r = scarce,
+ = somewhat numerous,
c = common,
cc = very common.

A. The greater Forms of animal Plankton.

a. Plankton Stations 1899—1900.

Nr.	Date	Name	Depth in metres	Corresponding samples in the hydr. tables
	1899			
1	12/1	Helligvær, 10 miles NW of H.	0—50, 0—250	28—40
2	13/1	Vestfjord I, between Helligvær and Værø	0—50, 0—100, 0—180	41—52
3	—	Vestfjord II, nearer Værø	0—50, 0—100, 0—200	53—63
4	14/1	Moskenstrømmen	0—50, 0—100	66—70
5	17/1	Reine. 8 miles SE of R.	0—150	73—80
6	—	Stamsund, 8 miles SbE of S.	0—50, 0—100	81—86
7	—	Henningsvær, 7 miles S of H.	0—50, 0—180	89—90
8	18/1	Yttersiden, 23 miles NW of Gaukværø	0—50, 0—110	91—97
9	19/1	40 miles NW of Gaukværø	0—50, 0—100, 0—700	105—121
10	21/1	Senjen, 12 miles NWbW of Maanesodden	0—5, 0—50, 0—130	126—133
11	23/1	Tromsøsundet	0—5	134
12	24/1	Kvænangen I, between Løgø and Brynilen	0—5, 0—50, 0—140	135—144
13	—	Kvænangen II, between Spildern and Kvænangstinderne	0—5, 0—50, 0—180	145—154
14	27/1	Lyngen I, off Skibotn	0—5, 0—50, 0—115	155—162
15	—	Lyngen II, off Kaafjord	0—50, 0—100, 0—250	163—173
16	—	Lyngen III, off Spokenes	0—50, 0—200	174—181
17	29/1	Malangen, between Lysbotn and Stønnesbotn	0—100, 0—300	182—194
18	31/1	Følstad, Østnesfjord	0—50, 0—135	214—223
19	—	Helle, Østnesfjord	0—50, 0—150	224—234
20	—	Høla, Svolvær	0—50, 0—150	196—206
21	1/2	Henningsvær, 8 miles SbW of H.	0—50, 0—100	235—240
22	—	Vestfjord, 8 miles SSE of H.	0—50, 0—200	
23	—	Skroven, 4 miles S og S.	0—300	241—245
24	3/2	Raftsundet, off the Troldfjord	0—50	246—250
25	—	Raftsund II, between Aarstenen and Ulvaag	0—100, 0—200, 0—260	251—258
26	4/2	Skroven, 5 miles ESE of S.	300—350, 0—100, 0—200, 0—300, 0—380	259—268
27	6/2	Tranødybet, between Tranø and Lødingen	0—50, 0—100, 0—200, 0—630	269—281
28	7/2	Ofoten I, between Havnes and Ramsund	0—100, 100—200, 200—300, 300—350	282—292
29	—	Ofoten II, between Bogen and Ballangen	0—100, 100—200, 200—250	293—301
30	8/2	Rombaken I, at the head of R.	0—40	302—306
31	—	Rombaken II, off ytre Sildvik	0—100	307—311
32	—	Rombaken III, inside Øijord	0—100, 100—200, 200—300	312—321
33	9/2	Skjomen I, at Elvegaard	0—40	322—324
34	—	Ofotenfjord, off Skarstad	500—550	331
35	13/2	Skroven, 5 miles SWbS of S.	0—50, 0—100, 0—200, 0—250	339—349
36	—	Strømmen I, at Henningsvær	0—80	332—335
37	—	Strømmen II, at Henningsvær	0—30	336—338
38	16/2	Mouth of the Raftsund	0—275	
39	17/2	Øxsund, between Hammerø and Lundø	0—100, 0—150, 150—250, 250—350, 350—450, 450—550, 550—620	351—362
40	18/2	Sagfjorden I, inside Furrunesvæggen	0—50, 0—100, 0—200	363—368
41	—	Sagfjorden II, outside Furrunesvæggen	0—300	
42	21/2	Henningsvær I, 4 miles SSW of H.	0—85	369—372
43	—	Henningsvær III, 16 miles SSW of H.	0—100, 0—200' 0—250	377—385
44	1/3	Evenstad I, 7 miles SE of Lofotodden	0—50, 0—150	405—411
45	—	Evenstad II, 10 miles SE of Lofotodden	0—100, 0—200	412—419
46	—	Moskenstrømmen	0	
47	3/3	Kirkfjord I, inside Vorfjorden	0—100	420—423
48	4/3	Reine I, 11 miles SE of R.	0—50, 0—150	426—435
49	6/3	Ure I, $9^1/_2$ miles SSE of U.	0—100, 0—200	436—443
50	—	Henningsvær I, 6 miles SWbW$^1/_2$W of H.	0—100, 0—140	444—450
51	10/3	Raftsundet	0—45	479—481
52	—	Risværflaket, outside the Øgsfjord	0—50, 0—150	455—460
53	11/3	Kanstadfjord III, inside the ridge	0—90	488
54	14/3	Øgsfjord I, at the head of the fjord	0—90	522—525
55	—	Øgsfjord II, at Halvarsø	0—200	526—531
56	16/3	Tranødybet, between Tranø and Lødingen	0—50, 0—100, 100—200, 200—300, 300—400, 400—500, 500—600	532—542
57	18/3	Tranødybet	0	544
58	20/3	Henningsvær II, 6 miles SbE$^1/_2$E of H.	0—100, 0—280	579—589
59	21/3	Værø, 7 miles SbW of Maahornet	0—100, 0—170	596—603
60	22/3	Røsthavet, 60 miles NW of Røst	0—100, 0—900	604—618
61	24/3	Røst I, outside R.	0—120	623—628
62	—	Røst II, outside R.	0—100	631—633

Nr.	Date	Name	Depth in metres	Corresponding samples in the hydr. tables
	1899			
63	25/3	Røst II, further in than Røst	0—150	640—644
64	28/3	Tysfjord I, further in than Skarberget	0—100, 0—700	651—663
65	29/3	Tysfjord II, further in than the Tysfjord church	0—100, 0—400	664—672
66	—	Tysfjord I	0—50, 0—100, 100—200, 200—300, 300—400, 400—500, 500—600, 600—700	
67	1/4	Lille Molla	0	
68	4/4	Følstad, Østnesfjorden	0—3	688—689
69	—	Helle, Østnesfjorden	0—3	692—693
70	—	Brettesnes II	0—3	682—683
71	—	Skroven	0—3, 0—150	697—702
72	—	Høla, at Svolvær	0—3, 0—150	703—709
73	10/4	Stene in Bø, Vesteraalen	0	
74	11/4	Gaukværø II, Vesteraalen	0—3, 0—250	748—756
75	12/4	Malangen, off Stønnesbotn	0—100, 0—380	757—767
76	13/4	Stønnesbotn	0—3	
77	—	Senjenhavet	0—80	772
78	14/4	Malangen	0—3, 0—50, 50—100, 100—200, 200—300, 300—380	773—782
79	19/4	Kvænangen I, betw. Spilderen and Kvænangstinderne	0—50, 0—160	783—789
80	—	Kvænangen II, off Nøklen island	0—90	790—793
81	20/4	Jøkelfjord, at the head of the fjord	0—3, 0—50, 0—100	794—798
82	21/4	Jøkelfjord III, off the Tverfjord	0—90	799—802
83	—	Kvænangen, between Spilderen and the northern mainland	0—100, 100—200, 200—300	803—810
84	22/4	Hammerfest harbour	0—8	
85	23/4	Troldfjord, in Rolfsø	0—6	
86	24/4	Ingøhavet	0—100, 0—300	811—823
87	25/4	Breisund	0—3	830—832
88	26/4	Repvaag harbour, Porsangerfjord	0—10	
89	27/4	Porsangerfjord	0—75, 100—200	833—840
90	1/5	Vardø	0—200	847—853
91	3/5	Lyngen I, off Skibotn	0—100	861—866
92	—	Lyngen II, off the Kaafjord	0—250	867—874
93	—	Lyngen III, between Gamvik and Ulø	0—300	875—884
94	5/5	Høla, Svolvær	0—150	885—893
	1900			
95	20/3	Høla, Svolvær	0—50, 0—140	894—901
96	—	Skroven, 1 mile SSE of S.	0—50, 0—100, 0—400	902—912
97	—	Henningsvær, $2^3/_4$ miles off H.	0—50, 0—100, 0—200	914—921
98	21/3	Strømmen at Henningsvær	0—60	929—931
99	—	Balstad I	0—50, 0—100, 0—200	932—941
100	—	Reine	0—110	957—960
101	22/3	Tranødybet	0—600	961—973
102	23/3	Østnesfjord I, at the head	0—25	981—982
103	—	Østnesfjord II, between Vaterfjord and Følstad	0—130	983—988
104	—	Østnesfjord III, off Helle	0—130	989—994
105	26/3	Ørsnes	0—100	995—998
106	—	Balstad	0—130	1004—1008
107	27/3	Reine	0—150	1009—1013
108	30/3	Vestfjord	0—25	
109	2/4	Skjerstadfjord II	0—100, 0—180	1025—1030
110	—	Skjerstadfjord IV	0—330	1031—1033
111	—	Skjerstadfjord V	0—420	1034—1043
112	3/4	Skjerstadfjord VII	0—490	
113	4/4	Skjerstadfjord XII	0—50, 0—100, 0—500	1047—1054
114	5/4	Misværfjord	0—25	
115	—	Seivaagen, Saltenfjord	0—20	
116	—	Saltenfjord II	0—50, 0—330	1056—1066
117	6/4	Foldenfjord	0—530	1067—1078
118	—	Foldenfjord I	0—100, 100—200, 200—300, 300—400, 400—500	1067—1078
119	7/4	Vestfjord, between Fladø and Skroven	0—50, 0—315	1079—1089

b. Plankton tables.

Date	12/1 1899		13/1						14/1		17/1					18/1	
Station	Helligvær		Vestfjord I			Vestfjord II			Mosken-strømmen		Reine	Stamsund		Henningsvær		Yttersiden	
Depth in metres	0—50	0—250	0—50	0—100	0—180	0—50	0—100	0—200	0—50	0—100	0—150	0—50	0—100	0—50	0—180	0—50	0—110
Fish eggs																	
Pasiphæa tarda																	
Nyctiphanes norvegica																	
Boreophausia inermis											rr						
Thysanoessa neglecta																	
— *longicaudata*			rr				rr										
Boreomysis arctica																	
Hemimysis abyssicola																	
Eggs and Larvæ of *Schizopoda*																	
Parathemisto oblivia													rr				
Euthemisto compressa																	
Nauplii and *Cypris* of *Cirripedia*																	
Conchoecia sp																	
Calanus finmarchicus	r	c	r	r	c	r	r	c		r	+	r	r		c	r	+
— *hyperboreus*																	
Pseudocal. elongatus	r	r		r	+		r	r		+	r					r	
Chiridius armatus																	
— *tenuispinus*																	
Euchæta norvegica				rr									rr		rr		
Scholecithricella minor																	
Temora longicornis										rr							
Metridia lucens		c		r	+	rr	r	+		r	r		rr	rr	r		r
— *longa*		r															
Pleuromamma robusta																	
Heterorhabdus norvegicus																	
Candacia armata																	
Acartia sp.		r	r		r	r	r	r		r	r		r		r	r	r
Oithona similis	+	c	+	+	c	[illegible]	c	c	+	c	+	r	+	r	+	c	c
— *plumifera*					r		r	r	rr	rr			rr				rr
Microsetella atlantica	r	+	+	+	r	r	r	r	r		r		r	r	r	+	+
Oncæa conifera																	
Young and Larvæ of *Copepoda*		+	+		+	r		+		+						r	
Limacina balea								r		r							rr
Larvæ of *Gastropoda*																	
— - *Pelecypoda*																	
Oikopleura sp.																	
Fritillaria sp.								r									
Cyphonautes																	
Larvæ of *Echinodermata*																	
— - *Polychæta*																	
Chætognata							rr										
Bolina sp.																	
Arachnactis albida																	
Cupulita sarsii																	
Physophora borealis																	

Date	19/1			21/1			23/1	24/1									
Station	Gaukværø			Senjen			Tromsøsund	Kvænangen I				Kvænangen II			Lyngen I		
Depth in meters	0—50	0—100	0—700	0—5	0—50	0—130	0—5	0—5	0—50	0—100	0—140	0—5	0—50	0—180	0—5	0—50	0—115
Fish eggs																	
Pasiphæa tarda																	
Nyctiphanes norvegica																	
Boreophausia inermis																	
Thysanoessa neglecta																	
— *longicaudata*																	
Boreomysis arctica																	
Hemimysis abyssicola																	
Eggs and Larvæ of *Schizopoda*																	
Parathemisto oblivia																	
Euthemisto compressa											rr						
Nauplii and *Cypris* of *Cirripedia*																	
Conchoecia sp.			rr														
Calanus finmarchicus	r		rr			r		rr	r	+	c	cc	cc	cc	cc	cc	cc
— *hyperboreus*																	
Pseudocal. elongatus						r	r			r	r			r	r		r
Chiridius armatus																	
— *tenuispinus*																	
Euchæta norvegica																	
Scolecithricella minor																	
Temora longicornis																	
Metridia lucens											r	r		r			
— *longa*																	
Pleuromamma robusta																	
Heterorhabdus norvegicus																	
Candacia armata																	
Acartia sp.		r				r	r							rr			
Oithona similis	r	+	r		+	+	r		r	+	+	r	r	r	+	+	c
— *plumifera*					rr												
Microsetella atlantica				rr	rr	r	+		+	+	+	r	r	r	r	r	+
Oncæa conifera																	
Young and Larvæ of *Copepoda*																	
Limacina balea						rr											
Larvæ of *Gastropoda*																	
— - *Pelecypoda*																	
Oikopleura sp.										r				r			
Fritillaria sp.																	
Cyphonautes																	
Larvæ of *Echinodermata*																	
— - *Polychæta*																	
Chætognata		rr								rr	r			rr		rr	
Bolina sp.																	
Arachnactis albida																	
Cupidita sarsii							c										
Physophora borealis																	

27/1					29/1		31/1						1/2					3/2			
Lyngen II			Lyngen III		Malangen		Følstad		Helle		Høla		Henningsvær		Vestfjord		Skroven	Raftsund	Raftsund II		
0—50	0—100	0—250	0—50	0—200	0—100	0—300	0—50	0—135	0—50	0—150	0—50	0—150	0—50	0—100	0—50	0—200	0—300	0—50	0—100	0—200	0—260
								rr													
				rr					rr	r					rr					rr	
							r	r	r	r	rr					rr			rr	+	r
c	c	cc	r	c	r	r	r	c	r	c	r	+	+	+	r	cc	cc		+	c	c
		rr															rr			rr	r
	r	r		+	r	r	r	+		c	r	r		r					+	+	+
								rr		rr	rr					+	r			rr	
				rr																	
				+				r						+				rr			rr
		r		r																	rr
							r														
		r			r	r								r							rr
+	+	+	+	c	+	+	r	c	+	c	c	c	c		+	+	c	+	+	c	c
								rr						rr		rr	rr			rr	
r	r	r	r	+	+	+	r	c	+	c	c	c	c	c	+	c	+	+	+	c	c
											rr										
																				r	
						r															
					r	r															
																					rr
rr	rr							rr				rr		rr	rr	rr				rr	rr
		+																			

Date	4/2					6/2				7/2								
Station	Skroven					Tranødybet				Ofoten I				Ofoten II			Rom-baken I	Romb. II
Depth in meters	300—350	0—100	0—200	0—300	0—380	0—50	0—100	0—200	0—630	0—100	100—200	200—300	300—350	0—100	100—200	200—250	0—40	0—110
Fish eggs																		
Pasiphæa tarda													rr					
Nyctiphanes norvegica																		
Boreophausia inermis																		
Thysanoessa neglecta																		
— *longicaudata*																		
Boreomysis arctica																		
Hemimysis abyssicola									+									
Eggs and Larvæ of *Schizopoda*																		
Parathemisto oblivia				rr	rr						rr	rr	rr	rr	rr	rr		
Euthemisto compressa																		
Nauplii and *Cypris* of *Cirripedia*																		
Conchoecia sp.	r	r		+	+				c	+	+		+					
Calanus finmarchicus	c	r	cc	cc	cc	+	+	c	cc	c	cc	cc	cc	c	cc	cc	rr	
— *hyperboreus*	r				+				+		rr	rr	c		r	+		
Pseudocal. elongatus	r				r					r	+	+	+			+	r	+
Chiridius armatus					rr													
— *tenuispinus*													rr					
Euchæta norvegica			r	r	+			+	rr		+	+	+	+	+	+		
Scolecithricella minor																		
Temora longicornis																		
Metridia lucens			rr	r	r													
— *longa*	r			rr	r				r			+	+		r	+		
Pleuromamma robusta					rr													
Heterorhabdus norvegicus													r		rr			
Candacia armata					rr													
Acartia sp.			r															
Oithona similis	+	+	c	c	c	+	+	+	+	+	c	+	+	c	c	+	c	cc
— *plumifera*			rr	rr	rr	rr			rr			rr		rr	rr	rr		
Microsetella atlantica	+	+	c	c	c	+	+	+	c	+	c	+	+	c	c	+	c	c
Oncæa conifera				rr													rr	
Youngs and Larvæ of *Copepoda*																		
Limacina balea	r			r							r	r			r	r		
Larvæ of *Gastropoda*																		
— - *Pelecypoda*																		
Oikopleura sp.																		
Fritillaria sp.																	+	
Cyphonautes																		
Larvæ of *Echinodermata*																		
— - *Polychæta*																		
Chætognatha	rr				rr			rr	r	rr	r	rr	r	rr	rr	rr		
Bolina sp.																		
Arachnactis albida																		
Cupulita sarsii																		
Physophora borealis																		

8/2			9/2		13/2						16/2	17/2							18/2		
Rombaken III			Skjom. I	Ofo-tenfj.	Skroven				Strøm. I	Strøm. II	Raft-sund	Øxsund							Sagfjord		
0—100	100—200	200—300	0—40	500—550	0—50	0—100	0—200	0—250	0—80	0—30	0—275	0—100	0—150	150—250	250—350	350—450	450—550	550—620	0—50	0—100	0—200
															rr						
											rr										
		rr		+		rr		rr				r	rr		rr	rr	rr	rr			
				c								r	+	+	+	+	+	+			
+	c	cc	rr	c	r	+	c	cc	r	rr	c	cc	cc	cc	c	+	+	+	+	c	c
		+		+				r						rr	+	+	+	rr			
+	+					r	r						r	r	r	r					
																	rr				
							+					r	+	+	+	r	r	rr			r
												rr									
		rr					rr	r				rr	r	rr	rr						
		r		r									r	r	+	r	r	rr			
														rr		rr	rr				
								rr	rr												
+	c	+	+		r	c	+	c	+	r	c	c	c	c	c	+	c	r		+	c
								rr				r	+		rr						
+	+	r			r	r	r	+	+	r	+	c	c	c	c	+	c	c	r	+	c
														rr	rr						
		r		r								rr	rr	rr	rr	rr	rr	rr			

Date	18/2	21/2				1/3					3/3	4/3		6/3			
Station	Sagfj. II	Henningsvær I	Henningsvær III			Evenstad I		Evenstad II		Moskenstrøm	Kirkfj. I	Reine I		Ure I		Henningsvær I	
Depth in meters	0—300	0—85	0—100	0—200	0—250	0—50	0—150	0—100	0—200	0	0—100	0—50	0—150	0—100	0—200	0—100	0—140
Fish eggs													rr				
Pasiphæa tarda																	
Nyctiphanes norvegica																	
Boreophausia inermis																	
Thysanoessa neglecta																	
— *longicaudata*														rr	rr		
Boreomysis arctica																	
Hemimysis abyssicola																	
Eggs and Larvæ of *Schizopoda*																	
Parathemisto oblivia				rr	rr		rr						rr			rr	r
Euthemisto compressa																	
Nauplii and *Cypris* of *Cirripedia*																	
Conchoecia sp.																	
Calanus finmarchicus	c	+	+	c	cc	+	c	r	c		r	r	c	r	c	c	cc
— *hyperboreus*	r				r												
Pseudocal. elongatus		r		r	r		r	r	r							r	+
Chiridius armatus																	
— *tenuispinus*																	
Euchæta norvegica	r			r	r				rr								r
Scolecithricella minor																	
Temora longicornis																	
Metridia lucens		r					rr										
— *longa*	r																rr
Pleuromamma robusta																	
Heterorhabdus norvegicus																	
Candacia armata																	
Acartia sp.							rr										
Oithona similis	c	c	+	c	c	rr	c	r	+		cc	c	c	c	+	+	+
— *plumifera*	rr		rr	rr	rr	rr	r										
Microsetella atlantica	c	c	+	c	c		+	r	+		c	c	+	+	+	+	+
Oncæa conifera																	
Young and Larvæ of *Copepoda*																	
Limacina balea																	
Larvæ of *Gastropoda*																	
— - *Pelecypoda*																	
Oikopleura sp.																	
Fritillaria sp.																	
Cyphonautes																	
Larvæ of *Echinodermata*																	
— - *Polychæta*																	
Chætognata				rr	rr						r						
Bolina sp.																	
Arachnactis albida										+							
Cupulita sarsii										c							
Physophora borealis										+							

10/3			11/3	14/3		16/3							18/3	20/3		21/3		22/3		24/3	
Raft-sund	Risværflaket		Kan-stadfj. III	Øgsfj. I	Øgsfj. II	Tranødybet								Henningsvær II		Værø		Røsthavet		Røst I	Røst II
0—45	0—50	0—150	0—90	0—90	0—200	0—50	0—100	100—200	200—300	300—400	400—500	500—600	0	0—100	0—280	0—100	0—170	0—100	0—900	0—120	0—100
														+	+	rr				+	r
							rr			rr		rr			rr						
																			rr		
																				+	
								+	c	+	+	+									
r	c	+	+		c	cc	c	r	r	+	r	r		c	c	+	c	c	c	c	+
									+	r	r	r									
		r		c	+	+	+	r		r		r							r		
		r				r	r	+	+		r	r		r							
															rr					rr	
								rr		rr	rr	rr									
								rr													
																		rr			rr
r	+	+	c	c	+	c	c	+	+	r	r	r	rr	+	+	r	+	+	+	+	+
	rr						rr	rr			rr							rr			
r	+	+	c		+	+	+	+	+	r	r	r		+	+	r	+	r	r	+	+
																				rr	
						rr	rr		r	rr	r	+		rr	rr						

Date	25/3	28/3		29/3										1/4			
Stations	Røst II	Tysfjord I		Tysfjord II		Tysfjord I								Lille Molla	Følstad	Helle	Brettesnes II
Depth in meters	0–150	0–100	0–700	0–100	0–400	0–50	0–100	100–200	200–300	300–400	400–500	500–600	600–700	0	0–3	0–3	0–3
Fish eggs	+													c	r		+
Pasiphæa tarda									rr								
Nyctiphanes norvegica																	
Boreophausia inermis																	
Thysanoessa neglecta																	
— *longicaudata*																	
Boreomysis arctica																	
Hemimysis abyssicola																	
Eggs and Larvæ of *Schizopoda*																	
Parathemisto oblivia			r				rr	rr									
Euthemisto compressa																	
Nauplii and *Cypris* of *Cirripedia*																	
Conchoecia sp.			+				r	+		c	+	+	+				
Calanus finmarchicus	c	+	c	+	c	c	c	+	rr	rr	rr	rr	rr				
— *hyperboreus*			+		+	+	+	+	+	+	r	rr					
Pseudocal. elongatus			r	r													
Chiridius armatus																	
— *tenuispinus*																	
Euchæta norvegica		r	+		r		+	+	rr		rr		rr				
Scolecithricella minor																	
Temora longicornis																	
Metridia lucens																	
— *longa*			r					rr	rr	r			rr				
Pleuromamma robusta																	
Heterorhabdus norvegicus			rr									rr	rr				
Candacia armata																	
Acartia sp.																	
Oithona similis	+	+	+	r	r	+	r	+			r	r					
— *plumifera*																	
Microsetella atlantica	+	+	+	r	+	r	+	+		r	r	rr	rr				
Oncæa conifera																	
Young and Larvæ of *Copepoda*							cc	c		r		r	+				
Limacina balea																	
Larvæ of *Gastropoda*																	
— - *Pelecypoda*																	
Oikopleura sp.																	
Fritillaria sp.																	
Cyphonautes																	
Larvæ of *Echinodermata*																	
— - *Polychæta*							+										
Chætognata			+				r	+		+	+	+	+				
Bolina sp.																	
Arachnactis albida																	
Cupulita sarsii																	
Physophora borealis																	

4/4				10/4	11/4		12/4		13/4		14/4						19/4			20/4		
Skroven		Høla		Stene	Gaukværø II		Malangen		Stønnesbotn	Senjenhavet	Malangen						Kvænangen I		Kvæn. II	Jøkelfjord		
0—3	0—150	0—3	0—150	0	0—3	0—250	0—100	0—380	0—3	0—80	0—3	0—50	50—100	100—200	200—300	300—380	0—50	0—160	0—90	0—3	0—50	0—100
+	c	r	c														rr			c	r	r
							+		rr													
																rr						
							+	+		+	+	+	+	+	+	r						
				r			r	r						rr	rr	rr	r		r			
	c		c		rr	rr				c			rr	r			+	+	c		+	+
			rr																		rr	
																r		r	r		c	c
								rr							+	+						
	r		r																			
																						rr
	r														rr	rr					c	+
	+									+		rr		rr			+	+	+		+	+
																rr						
	c		r				rr							r	r		r	r	r		c	c
																			rr			rr
	+	c								+							+	+	+			
																			r			
										r												
																	+	+	+			
																					rr	
																					r	
																					c	+

Date	21/4				22/4	23/4	24/4		25/4	26/4	27/4		1/5	3/5			5/5
Station	Jøkelfjord III	Kvænangen			Hammerfest	Troldfjord	Ingøhavet		Breisund	Repvaag	Porsangerfj.		Vardø	Lyngen I	L. II	L. III	Høla
Depth in meters	0—90	0—100	100—200	200—300	0—8	0—6	0—100	0—300	0—3	0—10	0—75	100—200	0—200	0—100	0—250	0—300	0—150
Fish eggs					rr				rr		rr						rr
Pasiphæa tarda																	
Nyctiphanes norvegica																	
Boreophausia inermis																	
Thysanoessa neglecta																	
— *longicaudata*																	
Boreomysis arctica																	
Hemimysis abyssicola																	
Eggs and Larvæ of *Schizopoda*								r			r		c				
Parathemisto oblivia																	rr
Euthemisto compressa																	
Nauplii and *Cypris* of *Cirripedia*		+			+	+							+				+
Conchoecia sp.																	
Calanus finmarchicus		+	r		rr								+			rr	c
— *hyperboreus*																	+
Pseudocal. elongatus	+	+		r	r												
Chiridius armatus																	
— *tenuispinus*																	
Euchæta norvegica																	r
Scolecithricella minor		r															
Temora longicornis																	
Metridia lucens	rr		rr		rr												
— *longa*															rr		
Pleuromamma robusta																	
Heterorhabdus norvegicus																	
Candacia armata																	
Acartia sp.																	
Oithona similis		r	r										r			r	r
— *plumifera*							rr										
Microsetella atlantica	c	r	r	r	r	r						rr		rr			rr
Oncæa conifera																	
Young and Larvæ of *Copepoda*													c		+		cc
Limacina balea																	
Larvæ of *Gastropoda*																	
— - *Pelecypoda*																	
Oikopleura sp.			r		r											rr	
Fritillaria sp.																	
Cyphonautes																	
Larvæ of *Echinodermata*																	r
— - *Polychæta*		r			+	r				r							+
Chætognata			rr														
Bolina sp.					r												
Arachnactis albida																	
Cupulita sarsii		r			c												
Physophora borealis																	

20/3 1900								21/3					22/3	23/3			26/3		27/3	30/3	2/4	
Høla		Skroven			Henningsvær			Strømmen	Balstad I			Reine	Tranødybet	Østnesfjord I	II	III	Ørsnes	Balstad	Reine	Vestfj.	Skjerstad II	
0—50	0—140	0—50	0—100	0—400	0—50	0—100	0—200	0—60	0—50	0—100	0—200	0—110	0—600	0—25	0—130	0—130	0—100	0—130	0—150	0 25	0—100	0—180
	r	rr	r		r	+	+	r		rr		cc		r			c		cc			
													r									r
				rr																		
								r							r					r	+	
				+									c		+							+
		+	+	c	+	+	+	r	r	+	+	c	c				r	+	+			r
			rr	+									+									+
	r		r	r	r	r	+	+	r	r	+	r	+		+	+		r	r		r	+
			rr	+		rr	rr	rr		rr	+	rr	+		rr			rr	rr			
								rr														
				rr									r									r
				rr																		rr
+	c	+	+	+	r	r	r	+	r	r	+	+	c		c	+	c	+	+		c	c
											rr						rr					
+	c	+	+	+	r	r	r	+	r	r	+	+	c		c	c	c	+	+		c	c
																					rr	rr
+	+	r	+	c	c	c	c	+	+	+	+	c	c		+	c	c	c	cc		+	c
																				r		
r	r	r	r			r	r	r					r	r	+		r		r			r
								r				r	r	r	+	+	+	r	r			
				rr									+									c

Date	2/4		3/4	4/4			5/4				6/4						7/4	
Station	Skjerstadfj. IV	S. V	S. VII	S. XII			Misværfj.	Seivaag	Saltenfj. II		Folden	Foldenfj. I					Vestfjord	
Depth in meters	0—330	0—420	0—490	0—50	0—100	0—500	0—25	0—20	0—50	0—330	0—580	0—100	100—200	200—300	300—400	400—500	0—50	0—315
Fish eggs											r	r						
Pasiphaea tarda		rr																
Nyctiphanes norvegica																		
Boreophausia inermis																		
Thysanoessa neglecta																		
— *longicaudata*																		
Boreomysis arctica																		
Hemimysis abyssicola																		
Eggs and Larvæ of *Schizopoda*	+										r	r			r			
Parathemisto oblivia						rr					rr							
Euthemisto compressa																		
Nauplii and *Cypris* of *Cirripedia*	r		r	r	r	r		+	r	+		+						r
Conchoecia sp.	+	+	+		r	r					c	rr			+	+		
Calanus finmarchicus	r	r	rr	r	r	r			rr	r	r	+			rr	rr	r	
— *hyperboreus*	r	+	r	rr	r	+				r	+	+		rr	r	r	r	+
Pseudocal. elongatus	+	+		+	+	+						+	r					
Chiridius armatus																		
— *tenuispinus*																		
Euchæta norvegica	rr	rr	rr		rr					rr	r	rr	rr	rr	rr	rr		
Scolecithricella minor																		
Temora longicornis																		
Metridia lucens																		
— *longa*	r	r	r			r					r	rr			rr	rr		
Pleuromamma robusta																		
Heterorhabdus norvegicus														rr	r	r		
Candacia armata																		
Acartia sp.																		
Oithona similis	c	c	r	r	+	+	r	r		r	+	+	r		r			
— *plumifera*																		
Microsetella atlantica	c	c		+	+	+	+	r		r	+	+	r			rr		r
Oncæa conifera	rr	rr	rr	rr	rr	rr	rr											
Young and Larvæ of *Copepoda*	c	c	r	c	c	c	c	+	+	+	+	c	r		r	r		r
Limacina balea																		
Larvæ of *Gastropoda*																		
— - *Felecypoda*																		
Oikopleura sp.																		
Fritillaria sp.																		
Cyphonautes																		
Larvæ of *Echinodermata*	r									r	r							
— - *Polychæta*		r				r	r	+	+			r						
Chætognata	c	c	r			r					c		rr		r	cc		
Bolina sp.																		
Arachnactis albida																		
Cupulita sarsii																		
Physophora borealis																		

c. Remarks on some Plankton Forms.

Pisces.

Eggs and Larvæ.

In March and April 1896, fish spawn was regularly found in the plankton on the Lofoten banks. That the greater part of this belonged to cod was, I consider, unquestionable. In 1897, fish spawn was also noticed from $^{17}/_{3}$ to $^{1}/_{5}$[1]). In 1899, a considerable quantity of fish eggs was to be seen in the sea at Vest Lofoten, on March 20th and on April 1st a mass of fish eggs was seen on the East Lofoten banks. Also in 1900, fish spawn was noticed in the latter half of the month of March.

Particularly in 1897 several samples containing spawn were examined. Various sizes were found, right up to a diameter of 2.5 mm.; but the diameter of the majority was about 1.3 mm., which means that most of it was cod spawn. We also got a few cod larvæ in the tow net, as for instance on $^{1}/_{4}$ 1897 on the fishing ground at Reine. The characteristic pigment bands left no room for doubt that we really had caught larvæ of cod — their length was about 3.5 mm. It was quite remarkable how seldom one came upon a sterile egg. One cannot, however, because of this fact conclude that fertilization was carried out in a particularly effective way, indeed one can hardly exercise any control over this in the open sea. For cod spawn is doubtless subject to the same law as for instance, salmon spawn, which dies pretty quickly if it has not been fertilized. Some cod eggs were put into a glass of sea water, and it was seen that the eggs fell to the bottom as soon as they died. In the open sea also, the dead eggs without doubt sink to the bottom, so that it is not possible to gain a correct idea of the effectiveness of fertilization by counting the eggs capable of development which are found in the water.

Respecting the spawning of the skrei (*Gadus callarias* L.) reference should be made to HJORT's book „Fiskeri og Hvalfangst" (Fishery and Whale Catching), page 37 *et seq.*

Decapoda.

Pasiphæa tarda, KRÖYER.

By tow-netting, I have only obtained young individuals of this species. Quite rarely, single specimens have been found.

Thus $^{7}/_{2}$ 1899. Ofoten I, 300—350 mm., 1 specimen, length 27 mm.[2])
$^{29}/_{3}$ 1899. Tys Fiord I, 200—300 m., 1 specimen, length 26 mm.
$^{2}/_{4}$ 1900. Skjerstad Fiord V, 0—420 m., 1 specimen, length 33 mm.
$^{25}/_{11}$ 1902. The By Fiord, Bergen, 250—450 m., 1 specimen, length 12 mm.

I made the following notes about the specimen from Ofoten:— Body, quite transparent, brown eyes and a reddish tail appendix.

In „Bidrag til Kundskab om Christiania Fjordens Fauna" (Contribution to a Knowledge of the Fauna in The Kristiania Fiord) M. SARS describes the young of this species (p. 56—63, fig. 81—90). These were taken near Skroven in Lofoten by G. O. SARS and the smallest was 10 mm. in length.

[1]) Cf. NORDGAARD, „Contribution to the Study of Hydrography and Biology on the Coast of Norway". Tables 2, 4 a, 4 b.

[2]) Measured from the point of the rostrum to the tip of the tail.

As far as I can see, G. O. SARS was the first to observe the pelagic habits of this species. In „Crustacea II" from the Norw. North Atlantic Expedition (1876—78) he says (page 11): „Meanwhile, though the specimens in question all came up in the trawl from very considerable depths, reaching 1760 fathoms, yet the animal may, considering its obviously pelagic habits, have entered the trawl in some of the higher strata, during the upward passage of the apparatus." The expedition above mentioned also took its specimens of *Pasiphæa* with a trawl at the stations 33, 213 and 295. Of these stations 33 is in the southern part of the North Ocean, 213 about halfway between Jan Mayen and Norway and 295 (Lat. 71° 59′ N., Long 11° 40′ E.) is somewhat further north and east. It is easier now with the improved apparatus for pelagic fishing to catch the animal. It appeared in considerable numbers in the North Ocean[1]). With regard to the distribution of this species in the fiords of Norway, it may be mentioned that it has been found from The Kristiania Fiord up to Lofoten, but its distribution is now known to be extended over a larger area. In April 1899, I took specimens with a trawl in The Malang Fiord from a depth of 380 m. There is no doubt that it is rather common in certain other fiords. For instance, I have often seen it in the stomach of *Macrurus rupestris*, *Spinax niger* and *Gadus virens* from The Herlø Fiord near Bergen. The young individuals of this species mentioned as being taken in The Ofot, Tys and Skjerstad Fiords were all caught in the months February—April. Although it is not stated, it is likely that G. O. SARS took the young stages on which M. SARS has based his description, also sometime during the early spring months, for G. O. SARS was, in the years mentioned, making winter researches in Lofoten.

One would be inclined to think that about the middle of the winter is the time of propagation for this species. It is, however, reasonable to suppose that the propagation stretches over a period of several months. In the stomach of *Spinax niger* from The Herlø Fiord, I found $^{16}/_{7}$ 1897 a female with large eggs attached.

Another *Pasiphæa* female with eggs was found in the stomach of a *Gadus virens* from The Herlø Fiord $^{12}/_{6}$ 1902.

KRÖYER based his original description on specimens from Greenland, and the species is also said to be found on the east coast of North America.

Schizopoda.

Nyctiphanes norvegica, M. SARS.

As is the case with *Pasiphæa tarda*, this is a plankton form, which it is difficult to catch in small tow-nets. A large number of my specimens have been taken in a trawl. Here is a list of the various places in which they have been found.

$^{10}/_{2}$ 1897.	Sunderø (Vesteraalen), several specimens in the stomach of *Gadus virens.*			
$^{21}/_{1}$ 1899.	Helle (Østnes Fiord),	0—120 m.		1 jun. (tow-net).
$^{16}/_{3}$ —	Raftsund	0—275 m.	rr	—
$^{21}/_{1}$ —	Følstad, (Østnes Fd.),	0—135 m.	rr	—

[1]) Cf. HJORT, „Fiskeri og Hvalfangst" (Fishery and Whale Catching), p. 27.

22/3 1899. In Sea N. W. of Røst, 0—500 m. r (trawl).
11/4 — Gaukværø II, 0—250 m. rr —
21/4 — Kvænangen 0—340 m. rr —
24/4 — In Sea off Ingø, 0—300 m. rr —

I have specimens from the following places on the west coast of Norway: —

28/4 1897. The Fiord outside Bergen in the stomach of *Gadus virens.*
20/1 1899. Herlø Fd., 0—400 m. *jun.* rr (tow-net).
24/1 — On the coast off Herlø, 0—150 m. — —
21/9 — The Norw. Channel off the Kors Fiord. — —
17/5 — The Herlø Fiord, in the stomach of *Gadus virens.*
12/9 — The Hjelte Fiord about 100 m. rr (tow-net).
19/11 — Hennø in the „skjærgaard" beyond Bergen in the stomach of *Gadus virens.*

On Nansen's „Fram" expedition, a single specimen was taken on May 22nd 1894.[1])

On the Norw. North Atl. Exp. (1876—78) this species was noticed at most of the stations.

G. O. Sars writes[2]): „The present beautiful species was observed on the expedition in several localities, at a considerable distance from the coast, swimming about on the surface of the water, as a rule, however exclusively young individuals. At one of the stations (St. 75) west of the Namsen Fiord, the animal occurred in such profusion that the sea in some localities had a peculiar brownish tint." Professor Sars also mentions the species from the Kristiania, the Hardanger and the Vest Fiords.

Aurivillius[3]) has observed it in the surface layers of the Skagerack in August, and in the Gulmar Fiord towards the end of November. In the months of August and September, the specimens he obtained were generally found rather deep down.

The species is distributed from the Arctic Ocean to the coast of Portugal, and from Greenland to Massachusetts Bay.

C. Koelbel[4]) states the length of the largest specimen caught at Jan Mayen to be 36 mm. My largest specimen, taken in the sea off Ingø in Finmark, has precisely the same length; the largest specimen from the Herlø Fiord, near Bergen, was 32 mm.

Boreophausia inermis, Krøyer.

This species constitutes, as is well known, the principal food of the coal-fish and plankton eating whales. I will therefore give a complete account of the observations I have been able to make respecting the distribution of this animal.

17/2 1897. Svolvær (Lofoten), in the stomach of *Gadus callarias* +
28/2 — Øgs Fiord, 0—150 m. (tow-net) r
— — Between Barø and Lødingen, 0—200 m. (tow-net) r
3/3 — Svolvær in the stomach of *Gadus callarias* c
5/3 — Østnes Fd. at various places, 0—120 m. (tow-net) +
— — Raftsund, Trold Fd., Grund Fd. — r
29/3 — Reine, in the stomach of *Gadus callarias* +
14/1 1899. Reine, (Lofoten), 0—150 m. (tow-net) rr
17/1 — 8 miles S. E. of Reine — rr
27/1 — Lyngen III, 0—200 m. — rr
31/1 1899. Helle (Østnes Fd.), 0— 50 m. (tow-net). rr
1/2 — Vest Fiord, 0— 50 m. — rr
8/2 — Raftsund, 0—200 m. — rr
1/4 — Stene, (Lofoten) 100—200 m. — rr
12/4 — Malang Fiord, 0 m. — c
13/4 — Stønnesbotn 0— 3 m. — rr
24/4 — Sea off Ingø, 0—300 m. (trawl) r
6/3 1900. Henningsvær I, 0—140 m. (tow-net) *jun.* rr
31/3 — Beier Fiord, 0—150 m. (trawl) rr

The contents of the stomachs of coal-fish which were caught in the Porsanger Fiord[1]) in the summer of 1898, were for the most part composed of this species.

The presence of *Boreophausia inermis* along the coast of Bergen is also satisfactorily ascertained, a large quantity having been found in the stomachs of young coal-fishes caught off Hennø on 19/11 1902.

But it is not certain if the species is to be met with annually on this coast.

Aurivillius mentions the species in the Skagerack, and Norman[2]) gives Banff, Shetland, Moray Firth and Clyde district as places where it is found. The species is observed from Spitzbergen to the Skagerack and England, as well as from Greenland along the east coast of North America to about 42° N. The largest specimens I have found (in the Malang Fiord) were 25 mm. long.

Boreophausia raschi, M. Sars.

This species is distinguished from the foregoing by a toothlike projection on the sides of the carapace. The dorsal tooth, however, in front of telson is missing in *raschi.*

I have only found this species once, and that was at Helle in the Østnes Fiord, (5/3 1897, 0—120 m.).

It is known from the Kristiania Fiord (M. and G. O. Sars). The latter also mentions having ocasionally found the species on the west coast of Norway. It is also known from Greenland and Great Britain, a list of places where it has been found has been given by Norman[3]) and T. Scott.[4])

Thysanoessa neglecta, Krøyer.

There was no example of this species among the specimens taken in 1899—1900, but on 5/3 1897 I found it in the Østnes Fd., plankton 0—60 m. It was also found in the stomach of ocean-cod (*skrei*) which was fished at Svolvær 10/3 1897.

G. O. Sars mentions having taken the species in the Varanger Fiord.

I have the following notes from the west coast of Norway.

30/1 1900. The Hjelte Fiord, 0—220 m. tow-net rr
18/10 1902. Manger, in the stomach of *Clupea harengus* r
10/11 1902. Hennø, in the stomach of *Gadus virens jun.* r

The species is known from Greenland, (H. I. Hansen) the Siberian coast (Brandt), N. E. America. (S. I. Smith), besides Norman and T. T. Scott have mentioned several places on the British coast where it has been found.

---

[1]) G. O. Sars, Crustacea, p. 13. The Norw. North Polar Exped. 1893—1896.
[2]) Crustacea II. The Norw. North Atl. Exp. 1876—78, p. 12.
[3]) Die Plankton Fauna des Skageraks, p. 74. Kgl. Svenska Vet. Akad. Handl. 30, N. 3.
[4]) Die Oesterreichische Polarstation Jan Mayen. Beobactungs-Ergebnisse, III B. p. 48.

[1]) Sparre-Schneider have taken specimens at Kvænangen.
[2]) British Schizopoda of Families Laphogastridæ and Ephausiidæ. Ann. Mag. Nat. Hist., S. 6. Vol. IX, p. 461.
[3]) British Schizopoda, p. 462.
[4]) On the Distribution of Pelagic Invertebrate Fauna of the Firth of Forth and its vicinity. Part III. Sixteenth Annual Report of the Fishery Board for Scotland, V, p. 160.

Thysanoessa longicaudata, Krøyer.

With tow-nets, this species has only been caught at the following places: —

$^{18}/_{1}$ 1899.	The Vest Fiord I, 0—100 m.	rr
$^{6}/_{3}$ —	Ure I, 0—100 m., 0—200 m.	rr

My specimens were 10—12 mm. long.

On Nansen's Fram-expedition single specimens were taken at four different places in the Arctic Ocean; and Sars mentions the Varanger Fiord and the Sea between Norway and Jan Mayen (Norw. North Atl. Exped.) as other places where it has been found.

According to Norman[1]) this species together with *Nyctiphanes norvegica* was „trown up in enormous quantity in St. Andrew's Bay, April 22nd 1886". It is also known from Greenland (Hansen) and P. T. Clive[2]) has given a list of places where it has been found in recent years from 48°—67° N.

Boreomysis arctica, Krøyer.

As far as I know, this is the first time this species has been included in any account of plankton organisms.

There can, however, hardly be any room for doubt that it has planktonic habits, as it has several times been taken by townetting. As, for instance on

$^{14}/_{4}$ 1899 in the Malang Fd., 300—380 m. rr

From the western fiords of Norway I have noted the following: —

$^{29}/_{7}$ 1898.	The Herlø Fiord, in the stomach of *Macrurus rupestris*			+
$^{15}/_{10}$ —	The Herlø Fd.,	0—400 m.	tow-net	rr
$^{14}/_{2}$ 1901.	The Herlø Fd.,	0—400 m.	—	rr
$^{25}/_{11}$ 1902.	Fiord off Bergen,	250—450 m.	—	rr

This species, which was first described by Krøyer as being found in Greenland, has by G. O. Sars been taken in the Kristiania, Hardanger and Vest Fiords.

It has not yet been observed on the British Coasts.

Hemimysis abyssicola, G. O. Sars.

This species also seems to be a bathy-planktonic organism, it was at any rate found in the tow-net on $^{6}/_{2}$ 1899 in the deep off Tranø, 0—630 m.; both as *adulta* and *juniores*.

In the western fiords it has never been seen in plankton but has been found in considerable quantity in the stomach of *Macrurus rupestris* from the Herlø Fiord, $^{29}/_{7}$ 1898. *Boreomysis arctica* was also found in the same place.

G. O. Sars has taken this organism in the Kristiania and Hardanger Fiords and at Lofoten. It has not yet been included in the British fauna.[3]) Norman has caught it in the Trondhjem Fiord.

Eggs and Larvæ of *Schizopoda*.

As the *Schizopoda* play such a very important part in the economy of the northern seas, I will mention some observations made in the northern fiords.

$^{12}/_{4}$, $^{14}/_{4}$	1899.	The Malang Fd.,	0— 3 m.	+
$^{24}/_{4}$	—	Ingø	0—300 m.	r
$^{27}/_{4}$	—	The Porsanger Fd.,	0— 75 m.	r
$^{1}/_{5}$	—	Vardø,	0—200 m.	c
$^{20}/_{3}$	1900.	The Østnes Fd.,	0—130 m.	+
$^{2}/_{4}$	—	The Skjerstad Fd.,	0—330 m.	+
$^{6}/_{4}$	—	The Folden Fd.,	0—100 m.	r

The majority of these probably belonged to the species *Boreophausia inermis*.

Cumacea.

Pseudocuma longicornis, SP. Bate.

On $^{22}/_{7}$ 1897 I got a specimen of this species in the harbour at Brettesnes in Lofoten, the animal was swimming about on the surface.

T. Scott[1]) has on the other hand, several times caught it by tow-netting in the Firth of Forth. Sparre-Schneider has observed this species at Hillesø in the Malang Fiord, which is the northern limit for it.

With regard to its distribution cf. Dr. Carl Zimmer.[2])

Amphipoda.

Parathemisto oblivia, Kröyer.

This species is also, without doubt, one of the important organisms in the economy of the sea. I have specimens from a great many stations both in the northern fiords and on the west coast of Norway. Is is distributed from Greenland (Kröyer, Hansen) to 45° N. 50° W. (Cleve)[3]) and from Arctic Ocean. where it was taken by Nansen at 12 different stations, to The British Isles. Aurivillius has found this species in the Skagerack, but it has not up to the present time been noticed in the fiords of Sweden and southern Norway. The most southerly place at which I have taken this species was off Stavanger (58° 59′ N. 5° 21′ W.), where I found *juniores* in plankton on $^{7}/_{2}$ 1896.

In the plankton which I had under examination from „Heimdals" section between the Sogne Fiord and Iceland about the middle of May 1896, I constantly came across *juniores* from the surface layers, both from the region of the Gulf Stream and in the arctic water. Likewise *juniores* and sometimes *adulta* were observed in the Pudde Fiord (Bergen) from the middle of November 1896 to February 1897, 0—8 m. In the plankton material which the seal catcher Capt. H. Andresen collected for the biological station, a considerable number of *P. oblivia* were found, among them also a large number of *juniores* from the sea north of Jan Mayen (June and July 1897.[4])

Parathemisto is characterized by H. H. Gran[5]) as an arctic-oceanic organism, and the same author mentions for instance:—

„Im Mai 1901 hatte z. B. *P. oblivia* von ihrem Verbreitungscentrum im Eismeere bis zu Lofoten eine zusammenhängende Verbreitung an der Oberfläche." In another place (p. 95) numerous specimens of young *Parathemisto* are mentioned in May as one of the first appearances of the flourishing spring plankton.

In the North Ocean the months of May and June appear to be the most important time for the development of this species; although I have, on the other hand, observed young individuals in

1) British Schizopoda, p. 463.

2) The Seasonal Distribution of Atlantic Plankton Organisms, p. 31, 32.

3) Cf. Norman, On British Mysidæ, p. 146. Ann. Mag. Nat. Hist. S. 6, vol. X.

1) The Distribution of Pelagic Invertebrate Fauna of Firth of Forth, p. 167.

2) Die arktischen Cumaceen (Fauna arctica), B. I, p. 428.

3) The Distribution of Atlantic Plankton Organisms, p. 38.

4) Cf. Nordgaard, Contributions to the Hydrography of the North Ocean. Berg. Mus. Aarb. 1901, No. 2, p. 29.

5) Das Plankton des norwegischen Nordmeeres. Report on Norwegian Fishery and Marine Investigations. Vol. II, No. 5, 1902, p. 83.

the months from November to May in the neighbourhood of Bergen. In the Arctic sea, *Parathemisto* is of great importance as food for plankton eaters.

I have seen it in the stomach of *Gadus virens* both from Bergen and from Vesteraalen; and in March 1897 I noticed it also in the stomach of *Gadus callarias*, caught near Svolvær in Lofoten.

Euthemisto compressa, Goes.

G. O. Sars[1]) gives the following distribution for this species:— Davis Strait, East coast of Greenland, Jan Mayen, Hasvig (in West Finmark). Norman[2]) states that near Redcar from 10th to 12th of February 1892 there was a very rich Crustacean plankton, which was eagerly sought after by *Rissa tridactyla*. This plankton consisted chiefly of *Euthemisto compressa* which at that time was new to the British fauna, and there was also *Nematoscelis megalops* and *Thysanoessa longicaudata*. From the Firth of Forth T. Scott[3]) refers to this animal as occuring in February and November 1892 and in November 1893.

My observations are the following:—

$^{8}/_{2}$ 1897.	Sunderø (Vesteraalen), from stomach of *Gadus virens*.	
$^{24}/_{1}$ 1899.	Kvænangen I, 0—140 m. tow-net.	1 ♀.
$^{22}/_{3}$ —	The Røst sea, 0—700 m.	—

Euthemisto bispinosa, Boeck.

$^{8}/_{2}$ 1897. Sunderø (Vesteraalen) from stomach of *Gadus virens*.

G. O. Sars states the distribution of this species as follows:— Greenland, Spitzbergen (?) off Novia Scotia, Sørvær and Hasvig (in West Finmark).

Amathilla homari, Fabr.

Adulta, but still more *juniores* were noticed on $^{10}/_{2}$ 1897 in the surface water at Sunderø in Vesteraalen. Also in the sea beyond the belt of skerries (Skjærgaard) off Bergen on $^{28}/_{6}$ 1900, 0—5 m., young of this species were observed. Development would thus appear to take place in the winter and spring.

Cirripedia.

Lepas anatifera, Linn.

A splendid bunch on a glass ball (from a fishing net) drifted ashore in March 1899 on the outer side of Moskenesø in Lofoten.

Nauplii and Cypris of Cirripedia.

At certain times larvæ of *Cirripedia* may be found in large numbers in plankton. Amongst those I have myself noticed I will mention for instance those seen in April 1896 at Balstad in Lofoten, and in April 1897 at Røst. At the latter place, I also on March 24th 1899 noticed a number of these larvæ (Røst I, 0—120 m.), and about the middle of April in the same year they were numerous just beyond Vesteraalen, in the Malang Fiord, at Kvænangen, the Trold Fiord, at Vardø and at Høla near Svolvær.

1) An Account of the Crustacea of Norway, vol. I, p. 13.

2) British Schizopoda. Ann. Mag. Nat. Hist., s. 6, vol. IX, p. 463.

3) The Distribution of the Pelagic Fauna. 16th Ann. Rep. of the Fishery Board for Scotland. Part III, p. 176.

Ostracoda.

While arranging the specimens which have been collected, I have not in every case classified them according to species, but have grouped them as *Conchoecia sp.*

Single specimens have been classified, some by Prof. G. O. Sars, and I have identified some others by reference to Professor G. W. Müller's article in „Nordisches Plankton". The following species have been found.

Conchoecia elegans, G. O. Sars.

This species is, comparatively speaking, common in the Vest and adjoining fiords, as for instance the Ofot Fiord and Øx Sund, and is found rather deep down. In the Ofot Fiord on February 9th 1899, I took up a quantity of a species of *Conchoecia* in a closing net, a blueish light gleamed from the forepart of its body. Unfortunately, I was not, then and there, in a position to decide whether the flash of bluelight came from *borealis* or *elegans* or perhaps from both.

Conchoecia borealis, G. O. Sars.

This species too has been observed in the Vest and adjoining Fiords, e. g.

$^{4}/_{2}$ 1899.	Skroven I,	0—300 m.
$^{6}/_{2}$ —	Tranø dybet	0—630 m.
$^{7}/_{2}$ —	The Ofot Fiord I,	300—350 m.
$^{17}/_{2}$ —	Øxsund,	450—550 m.

Conchoecia obtusata, G. O. Sars.

Among the specimens which I took at Reine in Lofoten ($^{23}/_{4}$ 1896, 0—130 m.) were a few conchoecia, which Sars declared to belong to this species.

It is very likely that there were examples of this species in the collection made in 1899, but I can not state this with certainty.

Philomedes brenda, Baird.

On April 20th 1899 I took a specimen of this species in the Jøkel Fiord, and it was by G. O. Sars declared to be a male. Sparre-Schneider has noticed this species, both in the Kvænang and Malang Fiords.

Cladocera.

Evadne nordmanni, Lovén.

As far as my experience goes, it appears that *Cladocera* is very seldom seen in the winter plankton on our coasts, and the only species I can with certainty say I have noticed is *E. nordmanni*. There were single specimens in the samples from Lofoten, April 1896.

Copepoda.

Calanus finmarchicus, Gunnerus.

In his important work „Das Plankton des norwegischen Nordmeeres" (p. 56—66) Dr. H. H. Gran has given an exhaustive biological account of this species, and to this account I refer. On page 64 Dr. Gran says: „*Calanus finmarchicus* hat eine für jedes

Gebiet bestimmte Fortpflanzungszeit, und die Thiere sterben ab, nachdem sie sich einmal fortgepflanzt haben. Die Fortplanzungsseit ist an Norwegens Nordwest Küste April—Mai; die Thiere können wahrscheinlich hier ihre ganze Entwicklung in einem Jahre vollenden."

Gran calls this a working hypothesis, and as such it is very interesting, and future examinations must prove how far facts bear out the hypothesis.

Gran's remarks concerning the vertical movements of this species are of special interest (p. 64). „Die Thiere können bedeutende vertikale Wanderungen unternehmen, namentlich suchen sie im Spätherbst die Tiefe und kommen im Frühling wieder herauf; im Sommer sind die Jungen hauptsächlich in den oberen, erwärmten Schichten zu finden, während die älteren oft in der Tiefe umherschwimmen."

I have also noticed the vertical „wanderings" and I believe that we here have a very important factor to deal with.

For it will probably be proved that the movements of herrings are affected by the vertical alterations in the places where *C. finmarchicus* is to be found at different times of the year.

It will be seen in my plankton-tables too that this species in the winter shows itself in the upper layers of water, quite thinly spread in the surface layers, while the majority is in much deeper water. But some exceptions from this state of things have been noticed, and these deserve attention. For instance, on January 24th 1899, there were quantities of these animals at Kvænangen no deeper than 0—5 meters, and the same was seen to be the case on the 27th of the same month in the same year in the inner half of the Lyngen Fiord. To this striking biological phenomenon a parallel peculiarity is evidenced in the physical conditions of the layers of water, these being altogether unvarying both with regard to temperature and salinity (cf. nrs. 145—154, 155—162).

And in this fact there seems to lie an explanation for the appearance of herrings at times in the winter so far up near the surface in some of the northern fiords that they can be caught with nets.

To give an idea of the distribution of this species deeper down in the winter, in those fiords into which the ocean water flows, the following list of observations made is useful. Dr. Petersen's closing-net, with an aperture of about 0.09 sq. m. was used.

Calanus finmarchicus.

$^{7}/_{2}$ 1899. Ofoten I.

Depth. m.	Number of specimens.
0—100	105
100—200	474
200—300	930
300—350	772

Bottom 360 m.

$^{8}/_{2}$ 1899. Ofoten II.

Depth. m.	Number of specimens.
0—100	63
100—200	1031
200—250	1575

Bottom 258 m.

$^{8}/_{2}$ 1899. Rombaken III.

Depth. m.	Number.
0—100	10
100—200	52
200—300	677

Bottom 310 m.

$^{17}/_{2}$ 1899. Oxsund.

Depth. m.	Number.
0—100	424
0—150	520
150—250	260
250—350	148
350—450	41
450—550	32
550—620	18

Bottom 630 m.

These figures speak for themselves. In February 1899 the number of *C. finmarchicus* reached the maximum at a depth of 200—300 m.

It will also be seen from these observations that in the winter a really considerable number of this important plankton form may be found in the basins of the fiords, as that it may truthfully be said that there is food there for eventual winter herring shoals.

Again it will be noticed on reference to the table dealing with Oxsund ($^{17}/_{2}$ 1899), that *C. finmarchicus* is only found very sparsely distributed at the greater depths of 400—600 m. This is still further emphasized in the following figures.

$^{16}/_{3}$ 1899. Tranødybet.

Depth. m.	Number.
0—100	211
100—200	9
200—300	9
300—400	10
400—500	6
500—600	2

Bottom 640 m.

$^{29}/_{3}$ 1899. The Tys Fiord I.

Depth. m.	Number.
0— 50	55
0—100	110
100—200	15
200—300	2
300—400	1
400—500	1
500—600	1
600—700	1

Bottom 725 m.

At the two places last mentioned, however, the maximum proved to be in the upper 100 meters, while their appearance in the lower layers was very seldom.

These observations tend to show that even in winter there is no accumulation of *C. finmarchicus* in the greater depths in our fiords (400 mtrs. and more). One is tempted to ask whether the vertical movements previously mentioned are active or passive. It may be replied that the vertical currents, which are caused by the cooling of the surface during the winter, must necessarily influence the movements of the plankton and have a share in their downward course. If the movements of the animals are active, these are in this case assisted by the current in the water.

— It is not so easy to determine the spawning time for those species in which the ovisack is wanting. But even here there are interesting things to be noticed which have some connection with spawning, as for instance the fastening of spermaphores to the genital segment.

I have only a time or two observed females of *C. finmarchicus* with spermaphores affixed, *viz.* on $^{7}/_{2}$ 1899 Ofoten II, 200—250 m. and on $^{17}/_{2}$ 1899 Øxsund, 0—150 m.

Calanus hyperboreus, Kröyer.

I have found single specimens of this organism in the depths of our fiords, and in the Ofot Fiord in the winter of 1899 they were sufficiently numerous to deserve to be considered of importance as food for plankton-eating fish.

I will give a series of observations made of the numbers taken at different depths with Dr. Petersen's closing-net, which had an opening whose surface measure was about 0.09 m.².

$^{7}/_{2}$ 1899. Ofoten I.

Depth. m.	Number of females.	Number of males.	Total.
0—100			
100—200	1		1
200—300	29		29
300—350	74	8	82

Bottom 360 m.

$^{7}/_{2}$ 1899. Ofoten II.

Depth. m.	Number of females.	Number of males.	Total.
0—100			
100—200	9		9
200—250	25	1	26

Bottom 258 m.

$^{17}/_{2}$ 1899. Øxsund.

Depth. m.	Number of females.	Number of males.	Total.
0—150			
150—250	3		3
250—350			24[1])
350—450			28[1])
450—550	17	4	21
550—620	2	2	4

Bottom 630 m.

$^{16}/_{3}$ 1899. Tranødybet.

Depth. m.	Number of females.	Number of males.	Total.
0—100			
100—200			
200—300	11	1	12
300—400	5		5
400—500	6	2	8
550—600	4		4

Bottom 640 m.

$^{29}/_{3}$ 1899. The Tys Fiord I.

Depth. m.	Number of females.	Number of males.	Total.
0— 50			11 *juniores*
0—100			14 *juniores*
100—200			15
200—300			8
300—400			25
500—600			8
600—700			1

Bottom 725 m.

[1]) Consisting of both females, males and *juniores*.

These tables show the distribution of this copepod in the depths of the northern fiords. The number seems to reach its maximum at a depth of 300—400 metres, decreasing both at greater and lesser depths. It is of special interest that *juniores* may be seen in the layers of water no deeper than 0—50 m. (cf. $^{29}/_{3}$ 1899. The Tys Fiord I). In this way the supply can be replenished in basins which are shut off by comparatively high submarine ridges. It is a matter of importance to be able to determine the propagating time for plankton organisms, so I will mention some of the observations which I have made and which will serve as helps to determine this matter as far as *C. hyperboreus* is concerned.

As the foregoing tables show, there are many more females than males. Then again, at certain times of the year, not a single male is to be seen. It would seem that, except just at spawning time, hardly any fully developed males are to be found; or at any rate, only as a very great rarity. In plankton samples from the sea in the neighbourhood of Jan Mayen ($^{25}/_{6}$ 1897) I have, for instance, found hundreds of females, but not a single male.

As I mentioned previously, the development of spermaphores may be considered as a proof that spawning time has come. Spermaphores affixed to the first abdominal segments of females have thus been observed by me in specimens from the following places: —

$^{6}/_{2}$ 1899. Tranødybet, 0—630 m.
$^{7}/_{2}$ 1899. Ofoten II, 200—250 m.
$^{17}/_{2}$ 1899. Øxsund, 450—550 m.

In one single instance I have observed that a spermaphore had almost left the spermaphore-duct through its opening on the left side of the first abdominal segment, the fifth leg on the left side being at the same time inclined towards the spermaphore so as to be able to seize it ($^{2}/_{4}$ 1900. The Skjerstad Fiord II, 0—180 m.). In several cases I have observed eggs in the oviducts on their way towards the genital segment, and this too is a sure sign that spawning time has come. Dates for such observations are, among others, $^{7}/_{2}$ 1899. Ofoten I; $^{17}/_{2}$ 1899 Øxsund; $^{2}/_{4}$ 1900. The Skjerstad Fiord IV.

The eggs, which lay in a row in the canal leading from the ovary, were of a yellowish colour and were placed like beads on a string. These yellow strings of beads could be seen with the naked eye.

There is another thing, which in all probability has some purpose to serve at spawning time. I have noticed at such time, and as far as I remember only then, two red spots on the ventral side of the swollen genital segment in the females of *C. hyperboreus*. If these spots are not seen at other times, one has every reason to think that they are intended to serve some special purpose at that particular time, and it is natural to conclude that they are for the guidance of the males, possibly to show them were the spermaphores should be deposited.

Juniores have been frequently observed, as, for instance, on

$^{17}/_{2}$ 1899. Øxsund, 350—450 m.
$^{29}/_{3}$ 1899. The Tys Fiord I 0—50 m.
$^{5}/_{5}$ 1899. Høla, 0—150 m.
$^{20}/_{2}$ 1900. Skroven, 0—100 m.
$^{22}/_{3}$ 1900. Tranødybet, 0—600 m.
$^{6}/_{4}$ 1900. The Folden Fiord, I 300—500 m.

From the foregoing statements it would seem that propagation time for *C. hyperboreus* in the northern fiords may be taken to be the months of February, March and April. I have no observations for the summer and autumn months from the fiords mentioned, so that I am unable to say anything as to whether propagation continues after April.

There is no doubt that this arctic copepod propagates in our fiords, but as young have been found in the upper layers (0—50 m.) there seems to be nothing unlikely in presuming an inflow, also in those basins which are shut off by submarine ridges.

Pseudocalanus elongatus, Boeck.

A glance at plankton tables will convince us that this is one of the most common copepoda in the winter plankton in the northern fiords.

It is easier to determine the propagating time for this species than for the two previously mentioned, as the females carry their eggs affixed to the genital segment. I have, however, only a few observations from the northern fiords, as for instance on $^{23}/_{3}$ 1900 when I saw females with eggs in the Østnes Fiord and again on $^{2}/_{4}$ in the same year in the Skjerstad Fiord. But from the skjærgaard off Bergen, I have observed such females from February to the beginning of May. It is possible that propagation continues after this time.

Chiridius armatus, Boeck.
Pl. II, Fig. 14.

Among the many samples of plankton from the northern fiords, I have only noted this species as being found at the following places: —

$^{4}/_{2}$ 1899. Skroven I, 0—380 m.
$^{17}/_{2}$ 1899. Øxsund, 450—550 m.
$^{12}/_{4}$ 1899. The Malang Fiord, 0—380 m.
$^{14}/_{4}$ 1899. The Malang Fiord, 200—300 and 300—380 m.

G. O. Sars[1]) has found this species from the Kristiania Fiord up to the Vest Fiord, which was its northern limit as far as was previously known. Now this limit can be extended to the Malang Fiord.

Chiridius tenuispinus, G. O. Sars.
Pl. II, Fig. 13.

This arctic copepod has only once been found in Norway. I counted every copepod in the samples from Ofoten I ($^{7}/_{2}$ 1899), 300—350 m. and found among them only one specimen of this species, a female 3.5 mm. in length.

Euchaeta norvegica, Boeck.

This species is a giant one among copepoda. I have measured several specimens of females which have reached a length of 8.3 mm. Below are some particulars which will give an idea of the distribution of *E. norvegica* at various depths.

$^{7}/_{2}$ 1899. Ofoten I.

Depth. m.	Number of females.	Number of males.	Total.
0—100			
100—200	3	2	5
200—300			9
300—350			11

Bottom 360 m.

[1]) Crustacea of Norway, Vol. IV, p. 28—29.

[17]/[2] 1899. Øxsund.

Depth. m.	Number of females.	Number of males.	Total.
0–150	1		1
150–250	5	2	7
250–350	3	3	6
350–450	1	2	3
450–550		3	3
550–620			

Bottom 630 m.

[16]/[3] 1899. Tranødybet.

Depth. m.	Number of females.	Number of males.	Total.
0– 60	2		2
0–100	1		1
100–200	2		2
200–300	2		2
300–400			
400–500	1		1
500–600		2	2

Bottom 640 m.

In 1899 *juniores* were observed in the plankton from January to April inclusive, and during the same time I have notes of many specimens of females with ovisacks. In some of them the bent ovarial tubes were seen to be full of the blueish eggs which shone through the body so that the blue ovarial tubes could be seen by the naked eye. In this species too, I noticed two red spots on the ventral side of the genital segment in females. I have suggested the hypothesis that these are for the guidance of the males when they deposit spermaphores.

It has been found on examination in the southern fiords that the spawning time for this species also takes place at other times than mentioned above, but I suppose that in the northern fiords the special time for spawning is during the first few months in the year, from January to April.

This species is one of the few plankton organisms, which I have found in the stomach of Lofot cod.

Scolecithricella minor, Brady.

This species was very rare in the plankton from the northern fiords.

G. O. Sars[1]) mentions having come across it from the Kristiania Fiord right up to Lofoten. I have found it in Øxsund ([17]/[2] 1899, 0—100 m.) and in Kvænang ([21]/[4] 1899, 0—100 m.) which must be taken as the most northernly place where this species has, up to the present, been observed.

[1]) Crustacea of Norway, Vol. IV, p. 56.

Centropages hamatus, Lilljeborg.

A single specimen of this species was found in a sample from Røst (Lofoten Islands) [1]/[5] 1897, and this was a female.

Temora longicornis, O. F. Müller.

This species provides a considerable amount of food in our waters for plankton-eating fish. As, however, on the south west coast it is particularly prominent in the summer and autumn months, it was not to be expected that it would often be met with in samples from the northern fiords, which were taken in the months of January, February, March and April. I have only noted it from Moskenstream ([14]/[1] 1899, 0—100 m.). On the contrary it has frequently been referred to as being found in several of the northern fiords in the autumn of 1898 and 1899 by Dr. Gran.[1]) Professor P. T. Cleve[2]) fixes the northern limit on the Norwegian coast at 70° N. for this species.

Metridia lucens, Boeck.

Off the coast of Bergen this species is at times so plentiful that it becomes of importance as food for plankton eaters. I have for instance found large quantities in the stomachs of young „sei“ (coal-fish).

By a look at the accompanying plankton tables it will be seen that this species is very generally distributed also in the northern fiords of Norway in the winter, but it is not seen in large numbers.

The following table gives the result of examination in this respect of the samples from Oxsund: —

[17]/[2] 1899. Oxsund.

Depth. m.	Number of females.	Number of males.	Total.
0–100	1		1
0–150	9		9
150–250	2		2
250–350	4		4
350–450			
450–550			
550–620			

The most northerly place at which I have found this species is Kvænang ([24]/[1] 1899). It emits a blueish light during preservation, and so does the species next to be considered.

Metridia longa, Lubbock.

This species is a typical deep water form in the fiords. The following tables give an idea of the quantities in which it is found at the various depths.

[1]) Hydr. Biol. Stud. of the North Atlantic Ocean and the Coast of Nordland. Cf. Plankton Tables.

[2]) Atlantic Plankton Organisms, p. 87.

$^7/_2$ 1899. Ofoten I.

Depth in meters	Number of females	Number of males	Total
0—100			
100—200			
200—300			10
300—350			15

Bottom 360 m.

$^7/_2$ 1899. Ofoten II.

Depth in meters	Number of females	Number of males	Total
0—100			
100—200	7	1	8
200—250	23	1	24

Bottom 258 m.

$^{17}/_2$ 1899. Oxsund.

Depth in meters	Number of females	Number of males	Total
0—100			
0—150	3		3
150—250	8		8
250—350	13		13
350—450	4		4
450—550	2	4	6
550—620	1		1

Bottom 630 m.

Pleuromamma robusta, Dahl.

Pl. II, Fig. 1—12.

In samples from The Vest Fiord (Skroven I, $^4/_2$ 1899, 0—300 m.) I found one single female specimen of a Pleuromamma, which I at first mistook for a *P. abdominalis*.

But on closer examination, I found that the first pair of antennæ were without the peculiar hooks which specially distinguish the latter species. Then I continued my examination on the lines laid down by Dr. Giesbrecht in his tables[1]), and came to the conclusion that my specimen was identical with the form described by F. Dahl found in the Atlantic, *viz. P. robusta*. As there were no drawings nor detailed description of the latter, I decided that I would treat my specimen very thoroughly and examine it still more closely, and then I prepared detailed drawings.

[1]) Copepoda (in „Das Tierreich"), p. 109.

Meanwhile, G. O. Sars's excellent drawings and description[1]) were published, so that my work became superfluous. I have, nevertheless, had my sketches reproduced, as the place where my specimen was found is considerably further north than there the ones previously mentioned have been found. My sketches may then be used as proofs that it was really a *P. robusta* I secured at Skroven in The Vest Fiord. Its length was 3.7 mm. According to G. O. Sars this species was taken by Dr. Hjort on the „Michael Sars" expedition, somewhat north of The Færoe Islands (stat. 9) and in The Stor Fiord in Søndmøre (stat. 4).

Heterorhabdus norvegicus, Boeck.

I have specimens of this species from The Ostnes Fiord, The Vest Fiord (Skroven, Tranødybet), Oxsund, The Ofot Fiord, The Tys Fiord, The Folden Fiord and The Skjerstad Fiord. It was only found in small quantities at all these places. There were a few fully developed males in addition to the more plentiful females. With respect to propagating time, it may be mentioned that *juniores* were noticed $^7/_2$ 1899 (Ofoten I, 300—350 m.), $^{17}/_2$ 1899 (Oxsund, 350—450, 450—550 m.) and again $^6/_4$ 1900 (The Folden Fiord, 200—300, 300—400, 400—500 m.).

Sars has found this species at various places from The Kristiania Fiord right up to Lofoten.

Candacia armata, Boeck[2]).

In The Vest Fiord ($^4/_2$ 1899, Skroven I, 0—380 m.) I took a single female specimen of this species, length 2.6 mm. This station at Skroven is the most northerly place where this species has, up to the present, been noticed.

Acartia clausi, Giesbrecht.

Under *Acartia sp.* in the tables, both *clausi* and *longiremis* are included. The form which was seen about the middle of January 1899 (12th—18th of January) was principally *clausi*.

Acartia longiremis, Lilljeborg.

This species was found occasionally among the samples, but never in any quantity worth mentioning.

Oithona similis, Claus.

Even if there should be no other plankton copepod to be found this species, however, is usually present, at any rate one may almost certainly find a few specimens, and, on account of its very general appearance, this species must be reckoned among the most important copepoda with regard to its ecological worth.

I have noticed females carrying their eggs in every month of the year in the fiords in the neighbourhood of Bergen.

Oithona plumifera, Baird.

As the tables show, this species was found at many places, but never in any quantity. It was also found off Ingø ($^{24}/_4$ 1899, Ingøhavet, 0—300 m.), and this is its northernmost limit as far as is now known. The geographical position of this station is: 71° 10′ N., 23° 10′ E.

[1]) Crustacea of Norway, Vol. IV, p. 115, Pl. 78, 79.
[2]) G. O. Sars, Crustacea of Norway, Vol. IV, pag. 135, pl. XCI.

Microsetella atlantica, Brady & Rob.

A glance at the tables will suffice to convince one that this species is one of the most important plankton copepoda. Propagating time is extended over a great part of the year, at any rate I have noticed females with ovisacks from February to July in the fiords in the neighbourhood of Bergen.

Oncæa conifera, Giesbrecht.

This easily recognized form was only rarely seen in the plankton. It was found in The Vest Fiord, The Jøkel Fiord and the Kvænang.

Pteropoda.

Limacina balea, Möller.

This species, which may sometimes be found in large quantities in the autumn, were only rarely found in the plankton. *Vide* tables.

Appendicularia.

Fritillaria borealis, Lohman.

What was found of *Oikopleura*, I have not been able to identify, but, on the other hand, the specimens which in the tables are classified under *Fritillaria sp.* are without doubt *F. borealis*.

Bryozoa.

Cyphonautes.

The larval form, which at times is tolerably general in the fiords in the neighbourhood of Bergen, can only with certainty be mentioned as having been found by me at one single place, *viz.* Raftsund. ($^3/_2$ 1899. Raftsund II, 0—260 m.).

Chætognatha.

Sagitta bipunctata, Quoy & Gaimard.

Under the designation *Chætognatha* two species, (*viz.* this and the following) will be found in my tables.

Meanwhile, however, I have noticed several places where *S. bipunctata* has been found, e. g. $^{16}/_3$ 1899, Tranødyb, 0—50 m.; $^{20}/_3$ 1899. Henningsvær II, 0—100 m.; $^{29}/_3$ 1899, Tysfiord I, 0—100 m.; $^{19}/_1$ 1899, 40 miles NNW of Gaukværø, 0—100 m. As far as my experience goes, this species on our coast is only found in the upper layers of water, but *Spadella hamata* is almost without exception found in samples taken from deep water. The species last mentioned has been found by me in quantities in the stomachs of young „sei" caught on the coast off Bergen.

Spadella hamata, Möbius.

I have found this species in large quantities in samples taken from deep water. Among the many places where it has been found, I may mention The Vest Fiord, Øxsund, The Ofot Fiord, The Tys Fiord, The Folden Fiord, The Skjerstad Fiord, &c. I have taken it both with townet and trawl[1]). I counted the specimens from Øxsund.

$^{17}/_3$ 1899. Øxsund.

Depth m.	Number of specimens
0—100	2
0—150	2
150—250	1
250—350	3
350—450	2
450—550	1
550—620	2

Bottom 630 m.

As before mentioned, this species as a rule is found at greater depths, but I can mention one exception. In the Skjerstad Fiord ($^3/_4$ 1900, Skjerstad fj. VIII, 0 m.) several large specimens were found swimming about in the surface water. This circumstance may perhaps be accounted for when the peculiar hydrographical character of The Skjerstad Fiord is remembered. The length of the fully developed specimens was 30—35 mm.; while those from Skjerstad Fiord were about 40 mm.

In samples from The Vest Fiord ($^{16}/_3$ 1899, Tranødyb, 300—400, 500—600 m.) there were specimens with eggbags. The hinderpart of the side fin was bent downwards, thus forming a hollow in which the eggs lay tightly pressed together.

In samples from the same place taken at a depth of 400—500 m. there were quantities of *juniores* (2—3 mm.) of a chætognath, which most probably was *S. hamata*.

Similar young individuals were also found, e. g. in The Tys Fiord ($^{29}/_3$ 1899, Tysfd. I) in samples taken at a depth af 300—500 m. but they were especially numerous in samples taken from a depth of 500—600 and 600—700 m.

Ctenophora.

Bolina infundibulum, Fabr.

Prof. Chun has identified *B. norvegica* M. Sars with this species. Chun writes[2]): — „Falls die von Mertens (1838) aus der Bering-Strasse beschriebene *B. septentrionalis* mit unserer Art identisch wäre (was aus der Abbildung nicht ohne weiteres hervorgeht), so dürfte auch *B. infundibulum* eine circumpolare Verbreitung aufwiesen."

This lobate Ctenophore has been noticed by me in the Jøkel Fiord ($^{20}/_4$ 1899) as well as in the sea at Hammerfest ($^{22}/_4$ 1899). Unfortunately I did not succeed in preserving any specimen. C. Vogt observed this beautiful form in 1861 in Lofoten.

Anthozoa.

Arachnactis albida, M. Sars.

Several specimens of this species were found in the surface water of Moskenstrømmen on March 1st 1899.

---

1) On the whole I have seen several of the larger plankton forms in the trawl, e. g. *Calanus hyperboreus*, *Euchæta norvegica*, *Parathemisto oblivia*, etc.

2) Die Beziehungen zwischen dem arktischen und antarktischen Plankton. (Stuttgart, 1897), p. 22.

Siphonophora.

Diphyes arctica, CHUN.

It is very interesting to be able to class this arctic siphonophor among the Norwegian fauna, as it is looked upon as being a typical or leading organism of the cold currents[1].

C. CHUN writes in this connection: — „*Diphyes arctica* ist eine hochnordische Form, welche in allen warmen Stromgebieten fehlt und gerade während der kältesten Jahreszeit (von Januar bis März) in der Baffins-Bai häufig erscheint."

A complete list of the distribution of this species as far as then known is given by F. RÖMER[2]. Both RÖMER and CHUN have specially emphasized the fact that this species is not found on the Scandinavian coasts. But this is no longer a fact; for in the winter of 1900, I found *Eudoxia arctica* at the following places:—

$^{3}/_{8}$ 1900, The Skjerstad Fiord VII, 0—490 m.
$^{6}/_{4}$ — The Folden Fiord I, 300—400 m.

I availed myself of Prof. CHUN's excellent descriptions and drawings, in „Die Siphonophoren der Plankton-Expedition" (Se Tab. I, Fig. 6), when identifying these specimens.

The bracts were of precisely the same shape, and there was the same arrangement of the canals, but there were no eggs in the gonophor. So I think that there can be no doubt that *Diphyes arctica* also belongs to the Norwegian fauna; this does not, however, necessarily weaken CHUN's opinion with regard to the zoogeographical character of this species. True the temperature at the place where I found it in The Folden Fiord was 6°.6 C. and salinity about 35 pro mille, but so many of the relict organisms from the glacial period have adapted themselves to the physical conditions in which they find themselves in a corresponding manner to the case here under consideration.

Cupulita sarsi, HAECKEL.

Agalmopsis elegans, M. SARS (part), Fauna littoralis Norvegiae (1846). Part I, p. 32, pl. V, figs. 1—6, pl. VI.
Cupulita sarsi, HAECKEL, Siphonophora (1888) Challenger Report, Vol. XXVIII, p. 234, 367.
— E. T. BROWNE, The Fauna and Flora of Valencia Harbour. R. I. A. Proc. Ser. III, Vol. V, p. 678.
Agalmopsis elegans, NORDGAARD, Some Hydrographical Results. Berg. Mus. Aarbog 1899, no. VIII, pag. 25.

As is well known MICHAEL SARS in 1846 gave a detailed description with drawings of Siphonophora collected at Florø (61° 30′ N.) including *Agalmopsis elegans*. Concerning this HAECKEL writes in 1888[3], „The genus *Agalmopsis* was described very accurately by SARS in 1846, and illustrated by excellent figures. The North Atlantic Agalmidæ, however, which are represented in his pls. V and VI, belong to two (or even three?) different genera. The first form, figured in pl. V, has simple terminal filaments of the tentilla, and belongs therefore to the genus *Cupulita*.

The second form, represented in pl. VI, has tricornuate tentilla, with an odd terminal vesicle and two paired lateral horns. This form may retain the original name *Agalmopsis elegans* and represent the type of this genus."

After a careful examination of the description and drawings given by MICHAEL SARS of *Agalmopsis elegans* one will certainly agree that HAECKEL is right in dividing into two genera. But, on the other hand, I have come to a different conclusion with regard to SARS's figures as applied to the two genera.

On SARS's pl. V the figs. 5 and 6 represent tentilla „with a spiral cnidoband, enveloped by a campanulate involucre"[1], and these, as well as fig. 1 show that the tentilla have simple terminal filaments, consequently they illustrate a species of *Cupulita*. But pl. V, figs. 7 and 8 represent tentilla with a terminal ampulla and two horns, and these are characteristic of the genus *Agalmopsis*. Neither can it be correct as HAECKEL mentions (l. c. p. 367) that pl. VI in SARS's work, represents *Agalmopsis elegans*.

On pl. VI fig. 1 the tentilla are drawn partly with, and partly without terminal filaments. Fig. 10, on the same pl. gives a detailed drawing of the latter kind, and this has given rise to the thought that SARS possibly had a third genus under examination when preparing his account. There is, however, no longer any reason for this supposition. In fig. 1 the tentilla without terminal filament are drawn smaller than those which are furnished with the terminal filament, and it is reasonable to conclude that the former represent them in course of development. If one compares pl. VI fig. 10 in SARS's work with pl. II fig. 8 in FEWKES[2] a striking resemblance will be noticed. FEWKES describes his fig. as representing an „embryonic tentacular knob" of *Cupulita (Nanomia) cara*, A. AGASSIZ.

It may surely be considered certain that SARS's fig. 10 represents a corresponding condition in *Cupulita sarsi*. This must be a *Cupulita* and not an *Agalmopsis*, for the tentilla which are developed are furnished with a terminal filament.

Thus it will be seen that SARS's descriptions and drawings almost exclusively are of the organism which HAECKEL das designated *Cupulita sarsi*, as only pl. V, figs. 7 and 8 can be considered as representing *Agalmopsis elegans*, M. SARS.

According to E. T. BROWN *C. Sarsi* is found on the west coast of Ireland (Valentia Harbour). As before mentioned, SARS made his collection at Florø.

I have observed this species in Moskenstrømmen ($^{1}/_{3}$ 1899) in Tromsø Sound ($^{23}/_{1}$ 1899), at Lyngen II ($^{27}/_{1}$ 1899), at Kvænangen II ($^{19}/_{4}$ 1899), in the Jøkel Fiord ($^{20}/_{4}$ 1899), at Kvænangen ($^{21}/_{4}$ 1899) in Hammerfest Harbour ($^{22}/_{4}$ 1899). At all these places they were found in great numbers near the surface of the water. Hammerfest is as far as is now known, the northernmost limit for *Cupulita sarsi*.

The question naturally suggests itself as to whether *Cupulita sarsi* and *C. cara* are one and the same.

To throw light on this point, I have compared both M. SARS's and FEWKES' (l. c. p. 213—223, pls. I, II, IIII) descriptions and drawings. There is a considerable coincidence with regard to figures representing general appearance (FEWKES pl. I, SARS pl. V fig. 1 and pl. VI fig. 1).

There is similarity with regard to the appearance of the adult tentilla (F. pl. II fig. 9 and S. pl. 5 fig. 5, 6) and the resemblance between the embryonic tentacular knobs (F. pl. II fig. 8, S. pl. 6, fig. 10) I have already mentioned. On the other hand, the tasters (hydrocystæ) appear to differ. FEWKES describes them (l. c. p. 218) as follows: — „They (the tasters) arise directly from the stem, and are destitute of a basal peduncle. The distal extremity is closed." Pl. II fig. 7 answers in every detail to this description. On comparing with this S. pl. 5 fig. 2, 3, where the tasters are described

1) Die Siphonophoren der Plankton-Expedition, p. 20.
2) Die Siphonophoren (Fauna arctica, II B., p. 174).
3) Challenger Report. Vol. XXVIII, p. 234.

1) HAECKEL (*loco citato* p. 233).
2) On certain Medusæ from New England 1888. Bull. Comp. Zool. (Harvard, Mass.), Vol. XIII.

as „lange Bläschen" (distinguished by the letter e), it will be seen that they are furnished with a basal peduncle, and that the top of the taster is somewhat extended and pointed. In his description of the tasters, FEWKES says that „the most marked peculiarity in their anatomy is the existence of an „oil globule" near their base." This „oil globule" is drawn by the writer mentioned and will be found on pl. II fig. 7. Nothing corresponding to this is found in SARS's pl. 5 figs. 2, 3. To discover if any such „oil globules" exist in *Cupulita sarsi* I examined the remains of a specimen from Tromsø sound. It was at once evident that while the majority of the various organs as usual fell to the bottom of the glass, there were a few small bits which remained on the surface of the preserving fluid (formalin). On closer examination, it was found that the little piéces floating on the surface were tasters which had risen to the top on account of their oil globules. Here too, there appears to be a difference between the two species under discussion. While the oil globules of *C. cara* according to FEWKES are sessile, those of *C. sarsi* are provided with a short peduncle. It is possible that the reason, why the oil globules do not appear on SARS's pl. 5 figs. 2, 8 is that they so easily burst on being touched. SARS has, however, given a drawing (pl. 6 fig. 11) of a taster with oil globule, which he considers to be „eine seltene Form der ovalen Bläschen", while the oil globule itself is described as „Kugeliger Anhang". These oil globules are most likely intended to act as a kind of hydrostatic apparatus.

As will be seen from the foregoing, differences can clearly be pointed out between *C. cara* and *C. sarsi*, and it is probable that they represent two different species which are, however, very similar. The fact of *C. sarsi* being found in large quantities in the winter in such fiords as Lyngen, Kvænang and Jøkel would seem to indicate that it is an arctic form, but one cannot be sure of this until its distribution is more clearly defined.

Physophora borealis, M. SARS.

Pl. IV, Figs. 1, 2.

In The Mosken current (Moskenstrømmen) several specimens of a *Physophora* were found swimming about near the surface, on March 1st 1899. On comparing M. SARS's drawings and descriptions[1]), I was convinced that it was his species which I had found. It has been thought that *borealis* was identical to *Physophora hydrostatica* of the Mediterranean, but this is, however, not altogether so sure as to be beyond doubt. If this should be proved to be the case SARS's name would have to give way for the older one, *hydrostatica*, FORSK.

M. SARS himself had an opportunity of comparing the Mediterranean form with the one he describes (l. c. p. 33) and it seems that he was acquainted with CLAUS's, GEGENBAUR's and KÖLLICKER's researches and examination of the former species. And as he still maintained that they were different, there is every reason to be wary before one concludes that they are not so.

M. SARS says, on page 40, „None of the urticary knobs observed by me shewed more than 5 spiral coils; but CLAUS (l. c. p. 26, fig. 26)[2]) in *P. hydrostatica* delineates 9—10 of them, and GEGENBAUR remarks that the spiral in the most perfect urticary knobs becomes decomposed and lies twisted together in irregular coils, which is also apparent in some of the specimens brought home by me from the Mediterranean."

In *borealis* too during the development of the tentacular knob, a dissolution of the spiral coils of the cnidoband takes place, after which they are reformed into irregular coils.

On Pl. IV fig. 1 in the present work a tentacular knob with spiral twisted cnidoband will be seen, while fig. 2, depicts a later stage, the spiral being unwound. I have observed intermediate stages between these two.

A thoroughly developed tentillum is depicted on SARS's pl. VI, fig. 7.

If it is a fact that the Coil unwinds itself in *P. hydrostatica*, then the figure given by CLAUS (pl. 26, fig. 26) cannot designate „ein vollkommen entwickelter Nesselknopf". But even if on this point there is a similarity, there would still remain the dissimilarity that during development the spiral twist in the tentacular knobs are more numerous in *hydrostatica* than in *borealis*.

1) Fauna littoralis Norvegiæ, h. 3. p. 32, pl. V, VI figs. 1—8.

2) Ueber *Physophora hydrostatica* nebst Bemerkungen ueber andere Siphonophoren. Sep. Abdruck aus Zeitschr. f. wiss. Zoologie. 10 B.

Craspedota.

(Notes and identification are due to Dr. EDWARD T. BROWNE, University College, London).

Aequorea sp.

1/8 1899. Moskenstrømmen o. m.
This is probably a new species.

Aglantha digitalis, MÜLLER.

22/3 1899. NW of Røst (Lofoten), 3 specimens.

This is a northern species. Recorded from Greenland, Norway, Faeroe Channel and in the North Atlantic by the „National" Plankton Expedition. There is no evidence that it has been taken south of about latitude 58°.

Aglantha rosea, FORBES.

2/4 1900. The Skjerstad Fiord IV, 0—330 m., 1 specimen.
— „ — „ V, 0—420 m., 1 specimen.

This medusa got mixed up with *A. digitalis* until I found out (1898) that it had eight sense organs. (*A. digitalis* has only four). Recorded from The British Isles and Heligoland.

Ptychogastria polaris, ALMAN.

6/4 1900. Folden Fiord, 3 specimens.
2/4 1900. The Skjerstad Fiord IV, 0—330 m., 1 specimen.
3/4 1900. „ — „ VII, 0—490 m., 2 specimens.

This medusa was taken in Discovery Bay in Grinnel Land, up Smith Sound on the west side of Greenland. (*Pectyllis arctica* from Greenland and off Halifax—Challenger Exped.).

Homooenema platygonon, MAAS.

2/4 1900. The Skjerstad Fiord V, 0—420 m., 1 specimen.
3/4 1900. „ — „ VII, 0—490 m., 2 specimens.

H. platygonon was taken by the „National" Plankton Expedition. The station is omitted in the Report.

B. Protistplankton.

By **E. Jørgensen.**

a. Plankton tables.

In the following tables r signifies rare, rr very rare (only one or very few specimens seen), r+ less rare, + frequent, +r less frequent, +c rather common, c common, cc very common, ccc in large quantities.

The method used for collection and examination only allows reliable conclusions as to the quality, not as to the quantity. From the signs used to indicate the more or less common occurrence it should, however, be evident which species are common or go to make up a considerable part of the plankton. It is, however, always to be remembered that the signs are only based upon a subjective judgment, not upon exact counting.

As a general characterization of the plankton — which for all stations, the sea off Vesteraalen (Yttersiden) perhaps excepted, is to be considered more or less unmixed coast plankton (neritic p.)—it may be stated that the Peridinæa in the winter season are predominant in quantity, together with Halosphæra, while the Diatomaceæ and likewise the Tintinnodea are of less frequent occurrence. This state is at once changed in the spring (about $^1/_4$ 1899, in 1900 $^{23}/_3$), when a few species of Diatomaceæ suddenly appear in large quantities, and remain for a considerable time at least more than one month, how long cannot be seen from the samples collected, as it was too early in the year, when the last samples were taken. During this time the other plankton is very much reduced in quantity, excepting Phæocystis, which species seems to have its optimum just in this period. The Peridinæa occur far less abundantly than earlier, not only in relation to the large masses of Diatomaceæ, but also absolutely.

This phenomenon, that might truly be named the inflow of Diatomaceæ, is a well known phase also in the development of the more southern coast plankton (see L. (= Literature, at the end of this essay) 1). Ostenfeld and Gran (L. 2 and 3) have also mentioned it, and try to explain the causes. It is an interesting fact that most of the leading species are identical, both in the northern and in the southern inflow of Diatomaceæ, on the extensive coast of Norway. Yet there are some few species characteristic of the northern, that seem to be entirely wanting in the southern, especially *Fragilaria oceanica*, partly accompanied by *F. cylindrus*, and *Chætoceros furcellatus* (besides some other, less predominant species).

As to quality the northern plankton is decidedly poorer than the southern, especially is this the case with the Tintinnodea.

Year 1899 Month	January														
Locality	Helligvær, 10 miles NW		Vestfjord I, between Helligvær and Værø		Mosken-strømmen		Reine, 8 miles SE	Stamsund, 8 miles StE		Henningsvær, 7 miles S		Yttersiden, 23 miles NW of Gaukvære		40 miles NW of Gaukvære	
Date	12/1	12/1	13/1	13/1	14/1	14/1	17/1	17/1	17/1	17/1	17/1	18/1	18/1	19/1	19/1
Depth (meters)	0—50	0—250	0—50	0—180	0—50	0—100	0—150	0—50	0—100	0—50	0—180	0—50	0—110	0—50	0—700
Salinity ($^0/_{00}$)	33.39	33.39—35.11	33.50	33.50—34.57	33.39—33.46	33.39—33.46	33.39—34.40	33.33—33.39	33.33—33.74	33.39		33.50		34.38	34.38—34.38
Temperature (Cels.)	4.3—4.4	4.3—7.3	4.6—4.9	4.6—6.5	4.1—4.5	4.1—4.7	4.2—7.1	3.9—4.3	3.9—5.5	4.2		4.1—4.7		5.9—6.4	5.9—3.6
I. Bacillariales. *(Diatomaceæ.)*															
Rhizosolenia alata BRIGHTW. *forma curvirostris* GRAN.	rr														
Biddulphia mobiliensis BAIL.	rr	..	r												
Chætoceros borealis BAIL.	rr														
C. b. var. *solitaria* CL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
C. convolutus CASTR.	..	..	rr												
C. atlanticus CL.	r	..	r	rr	..	..	..	..	rr	r	..	rr	..	r	r+
C. decipiens CL.	rr	..	rr	rr	..	rr	..	..	..	..	..	..	..	r	r
C. diadema (EHRB.) GRAN	rr														
C. curvisetus CL.	r														
Actinocyclus Ehrenbergii RALFS.	+r	r	r+	r+	r+	+	r	r	r	r	r	r+	r+	r	r
Roperia tessellata (ROP.) GRUN.	..	..	..	rr											
Coscinodiscus excentricus EHRB.	r+	r	r	r	r	..	r+	r	r	..	..	..	r	r+	r
C. lineatus EHRB.	..	..	...	..	..	..	..	..	..	..	..	..	..	..	r
C. curvatulus GRUN.	..	..	..	..	rr										
C. stellaris ROP.	rr	rr	..	..	rr	..	..	..	..	r	..	..	r	r	
C. radiatus EHRB.	+	r	r	r	r+	+	+	r+	r+	+	r	r+	r+	r+	+
C. subbulliens JØRG. n. sp.	..	r	r	..	r	..	..	..	..	..	..	..	..	..	r
C. centralis EHRB.	r+	+	r+	r+	r+	+	+	r+	+	r+	r	r+	r+	r	r+
C. concinnus W. SM.	..	r													
C. nitidus GREG.	..	..	..	rr											
Hyalodiscus stelliger BAIL.	r	r	..	r	r	..	r	r	r	..	r	r	r	r	r
Asteromphalus heptactis (BRÉB.) RALFS.	..	rr	..	rr	..	..	..	..	..	..	..	..	..	rr	rr
Thalassiothrix longissima CL. et GRUN.	..	rr	r	..	..	..	..	..	..	..	..	..	..	..	r
T. Frauenfeldii GRUN.	r														
T. F. v. nitzschioides (GRUN.) JØRG.	..	..	..	..	..	..	..	..	..	..	r				
Pleurosigma tenerum JØRG. n. sp.	..	..	..	..	..	..	..	..	..	r					
Euodia gibba BAIL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
(The following are doubtful as planktonforms, likely fixed species or such from the ground).															
Paralia sulcata (EHRB.) CL.	..	..	..	..	..	..	r								
Actinoptychus undulatus (BAIL.?) RALFS	r+	r													
Surirella lata W. SM.	..	rr	..	r											
Campylodiscus Thuretii BRÉB.	..	r	..	..	rr	..	..	..	r						
II. Peridiniales. *(Dinoflagellata.)*															
Prorocentrum micans EHRB.	..	..	..	..	..	..	..	..	..	..	rr				
Dinophysis acuta EHRB., JØRG.	+	+	r	r	r	r	r	r	r	r	r+	r+	r+	r	r
D. norvegica CLAP. et LACHM., JØRG.	rr	rr	r	rr	r	..	rr	.	..	rr	..	..	rr		
D. rotundata CLAP. et LACHM.	r	..	rr	rr											
D. homunculus STEIN	rr														

Year 1899. Month	January														
Locality	Helligvær, 10 miles NW		Vestfjord I, between Helligvær and Værø		Mosken-strømmen		Reine, 8 miles SE	Stamsund, 8 miles StE		Henningsvær, 7 miles S		Yttersiden, 23 miles NW of Gaukværø		40 miles NW of Gaukværø	
Date	12/1	12/1	13/1	13/1	14/1	14/1	17/1	17/1	17/1	17/1	17/1	18/1	18/1	19/1	19/1
Depth (meters)	0—50	0—250	0—50	0—180	0—50	0—100	0—150	0—50	0—100	0—50	0—180	0—50	0—110	0—50	0—700
Salinity ($^0/_{00}$)	33.39	33.39—35.11	33.50	33.50—34.57	33.39—33.46	33.39—33.46	33.39—34.40	33.33—33.39	33.33—33.74	33.39		33.50		34.38	34.38—34.38
Temperature (Cels.)	4.3—4.4	4.3—7.3	4.6—4.9	4.6—6.5	4.1—4.5	4.1—4.7	4.2—7.1	3.9—4.3	3.9—5.5	4.2		4.1—4.7		5.9—6.4	5.9—3.6
Podolampas palmipes STEIN	..	..	rr	rr											
Pyrophacus horologium STEIN	rr	..	rr	rr	r	..	..	..	r	..	..	..	..	..	rr
Protoceratium reticulatum (CLAP. et LACHM.) BÜTSCHLI.	r	..	r												
Diplopsalis lenticula BERGH	r	r+	r	r+	r	+	+	..	..	r+	r	r+	r+	..	+
Peridinium depressum BAIL.	r	+	r	+c	r	r+	+	+c	+	r+	+	+	+	r	+
P. oceanicum VANHÖFF	r	rr	..	..	..	..	r	..	r	..	rr				
P. divergens EHRB. (*P. lenticulare* (EHRB.) JØRG.)	c	c	c	c	c	+c	c	c	+c	c	c	c	+c	c	c
P. conicum (GRAN) OSTENF. et SCHM.	..	..	..	..	..	r+	..	..	..	..	..	..	..	..	+
P. pallidum OSTENF.	r	r	r	r+	r	r	r	r	r	r	+	r	r	r	r+
P. Steinii JØRG.	rr	r+	r	r+	..	rr	..	..	..	r	r+	r+	r	..	r
P. ovatum (POUCH.) SCHÜTT.	..	r+	r	+c	r	..	r+	..	r	..	r+	r+	r+	r	r+
Ceratium tripos (O. F. MÜLL.) NITZSCH. (*α balticum* SCHÜTT.)	cc	cc	cc	cc	cc	c	c	c	c	c	cc	c	c	+c	c
C. bucephalum CL.	c	c	c	cc	c	c	c	cc	cc	c	c	cc	cc	c	c
C. macroceros EHRB.	c	+c	+c	c	c	+	+c	c	c	c	c	+c	c	+c	+
C. intermedium (JØRG.)	c+	+c	c	cc	c	+c	+c	+c	c	c	+	c	+	+c	+
C. i. forma gracilis POUCH., JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
C. longipes (BAIL.) CL.	+	+c	+c	+c	c	+	+	+c	c	+c	c	c	+c	+	+
C. furca (EHRB.) DUJ.	c	c	c	+c	c	+c	c	+c	c	c	c	+c	c	+c	+
C. lineatum (EHRB.) CL.	r	..	r	..	..	..	..	r	r						
C. fusus (EHRB.) DUJ.	+	+	+	+	c	+	+	+	c	c	+c	c	+c	c	+
III. Pterospermataceæ.															
Pterosperma Möbii (JØRG.) OSTENF.	r+	r	r	r+	r	+	r	r+	r+	r	r	r+	r+	r	r
P. Vanhöffenii (JØRG.) OSTENF.	+	r+	r	r	..	r+	r+	r	+c	+	r+	+	r+	r	r+
P. dictyon (JØRG.) OSTENF.	+	+	+	+	+	c	+c	+	+c	+c	+	+	+	r	+
IV. Halosphæraceæ.															
Halosphæra viridis SCHMITZ (incl. *H. minor* OSTENF.)	cc	cc	cc	cc	cc	ccc	cc	cc	cc	cc	ccc	cc	cc	c	c
V. Silicoflagellata.															
Distephanus speculum (EHRB.) STØHR	rr	..	..	r	..	..	rr								
Dictyocha fibula EHRB.	r	rr	..	rr	..	..	r	rr	..	..	..	..	..	..	r
VI. Radiolaria.															
1. Spumellaria.															
Hexacontium pachydermum JØRG.	..	r	..	..	..	r	..	..	r						
Echinomma trinacrium HCK.	..	r+	..	r	..	..	..	..	..	..	..	..	..	..	+
E. leptodermum JØRG.	..	..	..	r	..	..	..	..	..	..	..	..	..	..	+
Drymyomma elegans JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r

Year 1899. Month	January														
Locality	Helligvær, 10 miles NW		Vestfjord I, between Helligvær and Værø		Moskenstrømmen		Reine, 8 miles SE	Stamsund, 8 miles StE		Henningsvær, 7 miles S		Yttersiden, 33 miles NW of Gaukvære		40 miles NW of Gaukvære	
Date	12/1	12/1	13/1	13/1	14/1	14/1	17/1	17/1	17/1	17/1	17/1	18/1	18/1	19/1	19/1
Depth (meters)	0—50	0—250	0—50	0—180	0—50	0—100	0—150	0—50	0—100	0—50	0—180	0—50	0—110	0—50	0—700
Salinity (‰)	33.39	33.39—35.11	33.50	33.50—34.57	33.39—33.46	33.39—33.46	33.39—34.40	33.33—33.39	33.33—33.74	33.39		33.50		34.38	34.38—34.38
Temperature (Cels.)	4.3—4.4	4.3—7.3	4.6—4.9	4.6—6.5	4.1—4.5	4.1—4.7	4.2—7.1	3.9—4.8	3.9—5.5	4.2		4.1—4.7		5.9—6.4	5.9—3.6
Chromyomma boreale (Cl.) Jørg.	..	..	..	r	..	..	..	..	..	..	..	..	..	..	r+
Rhizoplegma boreale (Cl.) Jørg.	..	r	..	r	..	..	..	..	r+	..	r	..	..	..	+
Stylodictya tenuispina Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Spongodiscus favus Ehrb.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Lithelius minor Jørg.	..	..	..	r	..	..	..	..	..	..	..	..	..	..	+
Phorticium pylonium Hck.? Cl.	..	..	..	r	..	..	..	..	..	..	r				
Sorolarcus circumtextus Jørg.	..	..	..	r	..	..	..	..	..	..	r	..	..	..	r
2. Nassellaria.															
Plagiacantha arachnoides Clap. et Lachm.	..	r	r	r	r	..	r	..	r	r	..	..	..	..	r
Plectacantha oikiskos Jørg. n. sp.	..	rr	..	r	..	..	..	..	..	..	..	..	..	..	r
Campylacantha cladophora Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Phormacantha hystrix (Jørg.) Jørg.	..	r	..	r	..	..	..	..	r	..	r	..	..	..	r+
Peridium longispinum Jørg.	..	r	..	r	..	..	..	..	r	..	r	..	..	..	r
Protoscenium simplex (Cl.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Cladoscenium tricolpium (Hck.?) Jørg.	..	r	..	..	..	..	..	..	..	..	..	..	..	..	r+
Dictyophimus Clevei Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r+
Lithomelissa setosa (Cl.) Jørg.	r	r	..	r	..	r	..	..	r	..	r	..	r	..	r
L. hystrix Jørg.	..	..	..	r											
Acanthocorys umbellifera Hck.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Dictyoceras acanthicum Jørg.	..	r	..	r	..	..	..	..	..	..	r	..	..	..	r
D. xiphephorum Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Clathrocyclas craspedota (Jørg.) Jørg.	..	r	..	r	..	..	..	..	..	..	..	..	..	..	r
Androcyclas gamphonycha (Jørg.) Jørg.	..	..	..	r	..	..	..	..	..	..	r				
A. amblycephalis (Jørg.) Jørg.	..	..	..	r											
Stichocorys seriata Jørg. n. sp.	..	..	..	..	..	..	..	..	rr	..	..	..	..	..	r
Gonosphæra primordialis Jørg. n. sp.	..	..	r	..	..	..	..	..	..	..	r				
3. Phæodaria (Tripylea).															
Cannosphæra lepta Jørg.	..	..	..	..	..	..	..	..	..	..	r				
C. geometrica Borg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Protocystis xiphodon (Hck.) Borg.	..	r	r	rr	..	..	..	..	..	..	r	..	..	..	r
P. Harstoni (Murray) Borg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
P. tridens (Hck.) Borg.	rr	r	..	r	..	..	..	..	..	..	..	r	r	..	r
Challengeron diodon Hck. (*C. heteracanthum* Jørg.)	..	r+	..	r	..	..	..	..	rr	..	..	..	..	r	rr
C. armatum Borg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Medusetta arcifera Jørg.	..	..	..	..	..	..	..	..	..	..	rr				
Gazelletta pentapodium Jørg.	..	..	..	..	r										
VII. Tintinnodea.															
Tintinnus acuminatus Clap. et Lachm.	..	..	r	r	..	r	rr	..	rr	r	r	..	rr		
T. a. var undata Jørg.	rr	r													

Year 1899. Month	January														
Locality	Helligvær, 10 miles NW		Vestfjord I, between Helligvær and Være		Mosken-strømmen		Reine, 8 miles SE	Stamsund, 8 miles StE		Henningsvær, 7 miles S		Yttersiden, 23 miles NW of Gaukværø		40 miles NW of Gaukværø	
Date	12/1	12/1	13/1	13/1	14/1	14/1	17/1	17/1	17/1	17/1	17/1	18/1	18/1	19/1	19/1
Depth (meters)	0—50	0—250	0—50	0—180	0—50	0—100	0—150	0—50	0—100	0—50	0—180	0—50	0—110	0—50	0—700
Salinity (‰)	33.39	33.39—35.11	33.50	33.50—34.57	33.39—33.46	33.39—33.46	33.39—34.40	33.33—33.39	33.33—33.74	33.39		33.50		34.38	34.38—34.38
Temperature (Cels.)	4.3—4.4	4.3—7.3	4.6—4.9	4.6—6.5	4.1—4.5	4.1—4.7	4.2—7.1	3.9—4.3	3.9—5.5	4.2		4.1—4.7		5.9—6.4	5.9—3.6
Amphorella quadrilineata (CLAP. et LACHM.) JØRG.	..	..	..	..	..	..	..	..	..	r					
A. Steenstrupii (CLAP. et LACHM.) DAD.	..	..	r												
A. ampla JØRG.	..	..	..	..	..	..	..	..	..	..	rr				
Ptychocylis urnula (CLAP. et LACHM.) BRANDT α *major* JØRG.	rr	..	..	r+	r	..	..	r	..	..	..	..	..	..	+
P. u. v. minor JØRG.	..	r	r	r	r	r+	r	..	r+	r	r	r	r	r+	c
P. u. v. digitalis AURIV.	..	..	..	r											
Tintinnopsis nitida BRANDT	rr	r	..	r+	r	r	..	..	..	..	..	..	rr	..	r
T. n. v. sinuata (BRANDT)	..	..	..	..	..	r									
T. n. v. ovalis JØRG. n. var.	..	..	r	r	..	r	r	r	..	r					
Codonella lagenula (CLAP. et LACHM.) ENTZ. v. *ovata* JØRG.	rr	..	..	..	r	..	rr	..	..	..	..	..	rr		
Cyttarocylis denticulata (EHRB.) FOL. α *typica* JØRG.	r+	r	r	r+	+	+	+	r+	+	+	+	+	+	+	+
C. d. var. *cylindrica* JØRG.	..	..	..	r	..	r	..	..	..	r+	r+				
C. d. v. *gigantea* (BRANDT) CL.	r	r	..	+											
C. d. v. *elongata* JØRG.	..	..	..	r	..	r	..	..	r	r+	..	..	r	r	
C. d. v. *subrotundata* JØRG.	..	..	r												
Dictyocysta templum HCK.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
D. t. v. *disticha* JØRG.	rr	r	r	rr	..	..	..	..	..	rr	r	..	rr	r	r+
Undella caudata (OSTENF.) CL.	rr	..	..	rr	..	..	..	..	..	..	..	..	rr	rr	r+

Year 1899. Month	January														
Locality	Senjen, 12 miles NWtW of Maanesodden			Tromsø-sundet	Kvænangen I, between Løgø and Brynilen			Kvænangen II, between Spildern and Kvænangs-tinderne			Lyngen I, off Skibotten			Lyngen II, off Kaafjord	
Date	21/1	21/1	21/1	23/1	24/1	24/1	24/1	24/1	24/1	24/1	27/1	27/1	27/1	27/1	27/1
Depth (meters)	0—5	0—50	1—130	0—5	0—5	0—50	0—140	0—5	0—50	0—180	0—5	0—50	0—115	0—50	0—250
Salinity (‰)		33.13		33.53		34.08	34.08	33.87	33.87	33.87	33.87	33.87	33.87	33.82—34.08	33.82—33.82
Temperature (Cels.)		3.3—4.3		0.6		3.6—3.9	3.6—4.0		2.6	2.6—3.1	1.1	1.1	1.1	3.0—2.6	3.0—1.6
I. Bacillariales. *(Diatomaceæ.)*															
Biddulphia aurita (Lyngb.) Bréb.	..	..	..	r	..	..	..	..	..	..	..	rr			
Chætoceros borealis Bail.	..	..	..	..	..	..	..	..	..	r					
C. decipiens Cl.	..	..	..	..	..	r	r	..	..	..	r	r	r+	..	r+
Actinocyclus Ehrenbergii Ralfs	r	r	r	..	r	r+	r+	..	r	r	r	r	r	r	r
A. subtilis (Greg.) Ralfs	..	..	..	..	..	..	rr								
Roperia tessellata (Rop.) Grun.	..	..	rr												
Coscinodiscus excentricus Ehrb.	..	r	r	..	..	r	r	..	..	..	..	r			
C. decipiens Grun.	..	..	r	..	..	..	r								
C. curvatulus Grun.	..	..	r	..	..	..	rr	..	r	..	..	r	r+		
C. stellaris Rop.	..	..	..	..	..	r									
C. radiatus Ehrb.	r	r+	r+	r	..	r+	r+	r	r+	r+	r+	r	r+	r+	r+
C. subbulliens Jørg. n. sp.	..	..	r	..	..	..	r								
C. centralis Ehrb.	..	r	r+	r+	..	r	r	r+	r+	r+	c	+c	+c	r+	+c
C. concinnus W. Sm.	..	..	..	..	..	..	r	r	r	..	..	..	..	..	r+
C. nitidus Greg.	..	..	r												
Euodia gibba Bail.	..	..	rr												
Hyalodiscus stelliger Bail.	..	..	r	..	..	r	r								
H. subtilis Bail.	..	..	..	..	..	..	r								
Asteromphalus heptactis (Bréb.) Ralfs	..	..	rr												
Thalassiothrix longissima Cl. et Grun.	..	r	r												
T. Frauenfeldii Grun. v. *nitzschioides* (Grun.) Jørg.	..	..	r	..	..	..	..	..	r	..	..	r	r+		
Pleurosigma tenerum Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	+c	c	+c	r	r
Actinoptychus undulatus (Bail.?) Ralfs	..	..	r												
Campylodiscus Thuretii Bréb.	..	..	..	..	..	..	..	..	..	r					
C. angularis Greg.	..	..	..	..	..	..	r	..	..	..	..	r			
Rhabdonema arcuatum (Lyngb.) Kütz.	..	..	r+												
Pleurosigma naviculaceum Bréb.	..	..	..	..	..	..	rr								
II. Peridiniales. *(Dinoflagellatæ.)*															
Dinophysis acuta Ehrb., Jørg.	..	r	r	..	..	r	..	..	r	r	..	r	r	r	r
D. norvegica Clap. et Lachm., Jørg.	..	rr	..	..	..	..	..	..	..	..	..	r	rr	rr	
D. acuminata Clap. et Lachm., Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
D. rotundata Clap. et Lachm.	..	..	..	..	..	..	..	..	..	..	..	rr	rr	..	rr
Pyrophacus horologium Stein	..	..	rr												
Gonyaulax spinifera (Clap. et Lachm.) Dies.	..	..	rr												
Diplopsalis lenticula Bergh	..	r	r	..	r	r+	+	+	r+	..	..	..	r	r	r+
Peridinium depressum Bail.	..	..	r	r+	..	+c	+c	c	+c	r+	r+	+c	+c	+	c
P. oceanicum Vanhøf.	..	r	..	..	..	..	r								
P. divergens Ehrb. (*P. lenticulare* (Ehrb.) Jørg.)	..	+c	+	+c	r	+c	c	c	c	+	+	c	c	+	c

Year 1899. Month	January														
Locality	Senjen, 12 miles NWtW of Maanesodden			Tromsøsundet	Kvænangen I, between Løgø and Brynilen			Kvænangen II, between Spildern and Kvænangs-tinderne			Lyngen I, off Skibotten			Lyngen II, off Kaafjord	
Date	21/1	21/1	21/1	23/1	24/1	24/1	24/1	24/1	24/1	24/1	27/1	27/1	27/1	27/1	27/1
Depth (meters)	0—5	0—50	1—130	0—5	0—5	0—50	0—140	0—5	0—50	0—180	0—5	0—50	0—115	0—50	0—250
Salinity (‰)		33.13		33.58		34.08	34.08	33.87	33.87	33.87	33.87	33.87	33.87	33.82—34.08	33.82—33.82
Temperature (Cels.)		3.3—4.3		0.6		3.6—3.9	3.6—4.0		2.6	2.6—3.1	1.1	1.1	1.1	3.0—2.6	3.0—1.6
Peridinium conicum (GRAN) OSTENF. et SCHM.	..	..	..	..	..	..	r	..	..	..	r	..	r	..	r
P. pallidum OSTENF.	..	r+	r	r	..	r	+	+	+	r+	r	+	+c	r+	r+
P. Steinii JØRG.	..	r	..	r	..	r	r	..	r	..	..	..	r	r	r+
P. ovatum (POUCH.) SCHÜTT.	..	r	r	..	..	+	+c	r	+	+	..	+c	+c	+	c
Ceratium tripos (O. F. MÜLL.) NITZSCH. (α *balticum* SCHÜTT.)	c	c	c	+	..	c	c	c	+c	+	..	r	+c	+c	c
C. bucephalum CL.	c	c	c	+c	r	c	c	c	c	c	c	+c	+c	c	c
C. macroceros EHRB.	..	c	+	+c	..	+c	+c	+	+	r+	+	+	+c	+	+c
C. intermedium (JØRG.)	..	+	+c	r+	r	+c	+c	c	+c	r+	r+	+	+	+c	+c
C. longipes (BAIL.) CL.	..	c	+c	+	r	+c	+c	r	r	r	+c	+c	..	+	+c
C. furca (EHRB.) DUJ.	..	c	+c	+	..	+c	+	+	+	r+	r+	r	r+	r+	+
C. lineatum (EHRB.) CL.	..	..	..	..	..	..	..	..	..	..	..	r			
C. fusus (EHRB.) DUJ.	..	+c	+c	+	r	+c	+	c	+	+	+c	c	+c	+c	+c
III. Pterospermataceæ.															
Pterosperma Möbii (JØRG.) OSTENF.	..	r+	r+	..	..	r	r	..	r	r	..	..	..	r	r
P. Vanhöffeni (JØRG.) OSTENF.	..	r	r	r	..	r	r	..	..	..	..	..	r	r	r
P. dictyon (JØRG.) OSTENF.	r	+	r+	r	r	+	+	r	+	+	r	r+	r+	+	+c
IV. Halosphæraceæ.															
Halosphæra viridis SCHMITZ. (incl. *H. minor* OSTENF.)	c	cc	cc	c	+	c	c	cc	c	c	c	+	+	c	c
V. Silicoflagellata.															
Distephanus speculum (EHRB.) STÖHR.	..	..	..	..	..	..	r								
Dictyocha fibula EHRB.	..	..	r	..	..	..	r								
VI. Radiolaria.															
1. Spumellaria.															
Hexacontium enthacanthum JØRG.	..	..	..	..	..	..	..	..	r						
H. pachydermum JØRG.	..	..	r	..	..	..	r+								
Echinomma trinacrium HCK.	..	r	r	..	..	..	r+	..	..	..	..	..	..	..	r
E. leptodermum JØRG.	..	..	r	..	..	..	+								
Drymyomma elegans JØRG.	..	..	r												
Chromyomma boreale (CL.) JØRG.	..	r	r	..	..	..	r								
Rhizoplegma boreale (CL.) JØRG.	..	r+	r	..	..	..	+								
Phorticium pylonium HCK.?, CL.	..	..	..	..	..	..	r								
Lithelius minor JØRG.	..	r	r	..	..	..	r+								
L. spiralis HCK.	..	r													

Year 1899. Month	January														
Locality	Senjen, 12 miles NWtW of Maanesodden			Tromsø-sundet	Kvænangen I, between Løgø and Brynilen			Kvænangen II, between Spildern and Kvænangs-tinderne			Lyngen I, off Skibotten			Lyngen II, off Kaafjord	
Date	21/1	21/1	21/1	23/1	24/1	24/1	24/1	24/1	24/1	24/1	27/1	27/1	27/1	27/1	27/1
Depth (meters)	0—5	0—50	1—180	0—5	0—5	0—50	0—140	0—5	0—50	0—180	0—5	0—50	0—115	0—50	0—250
Salinity (‰)		33.13		33.53		34.08	34.08	33.87	33.87	33.87	33.87	33.87	33.87	33.82—34.08	33.82—33.82
Temperature (Cels.)		3.3—4.3		0.6		3.6—3.9	3.6—4.0		2.6	2.0—3.1	1.1	1.1	1.1	3.0—2.6	[illegible].0—1.6
2. Acantharia.															
Radiosphæra anacanthica Jørg. n. sp.	..	..	..	..	..	..	..	..	r						
3. Nassellaria.															
Plagiacantha arachnoides Clap. et Lachm.	..	..	..	..	..	..	r	..	..	..	..	..	..	..	r
Plectacantha oikiskos Jørg. n. sp.	..	..	r	..	..	..	r+								
Campylacantha cladophora Jørg. n. sp.	..	..	rr	..	..	..	r								
Phormacantha hystrix (Jørg.) Jørg.	..	..	r	..	..	..	r+								
Peridium longispinum Jørg.	..	..	r	..	..	..	r								
P. minutum Cl.	..	r	r												
Cladoscenium tricolpium (Hck.?) Jørg.	..	..	r	..	..	..	r								
Dictyophimus Clevei Jørg.	..	..	r	..	..	..	r								
Lithomelissa setosa (Cl.) Jørg.	..	r	r+	..	..	..	r+	..	..	..	..	r			
L. hystrix Jørg.	..	..	..	..	..	..	r								
Acanthocorys umbellifera Hck.	..	r													
Dictyoceras acanthicum Jørg.	..	..	r												
D. xiphephorum Jørg.	..	..	..	..	..	..	rr								
Clathrocyclas craspedota (Jørg.) Jørg.	..	..	..	..	..	..	rr								
Stichocorys seriata (Jørg.) n. sp.	..	..	r	..	..	..	rr								
4. Phæodaria (Tripylea).															
Cannosphæra geometrica Borg.	..	..	..	..	..	..	rr								
Protocystis tridens (Hck.) Borg.	..	..	..	..	..	rr	r+	r	r	..	..	..	r+	r+	r
P. xiphodon (Hck.) Borg.	..	..	r	..	..	..	r								
Challengeron diodon Hck. (*C. heteracanthum* Jørg.)	..	r	..	..	..	..	r								
Medusetta arcifera Jørg.	..	..	rr												
Gazelletta pentapodium Jørg.	..	r													
VII. Tintinnodea.															
Tintinnus acuminatus Clap. et Lachm.	..	r	..	r	..	..	..	..	r	r+	..	r	r	..	rr
Ptychocylis urnula (Clap. et Lachm.) Brandt (α *major* Jørg.)	..	r													
P. u. v. *minor* Jørg.	..	r	..	..	..	..	r	..	..	..	..	..	r	r	
P. u. v. *subarctica* Jørg. n. var.	..	..	..	..	..	..	..	..	..	..	..	..	rr	..	rr
Tintinnopsis nitida Brandt	..	..	..	+	r	..	+	r	+	r+	r	+c	c	c	+c
T. n. v. *ovalis* Jørg. n. var.	..	..	..	..	..	r+	r+								
Cyttarocylis denticulata (Ehrb.) Fol. (α *typica* Jørg.)	r	r+	r+	r	r	+	r+	..	r	+	..	+c	+	+	+
C. d. v. *cylindrica* Jørg.	..	..	..	..	..	r+	..	r	..	+					
C. d. v. *gigantea* (Brandt) Cl.	..	..	..	..	..	..	..	..	..	..	..	..	..	r	
C. d. v. *robusta* Jørg.	..	..	..	..	..	..	r								
C. d. v. *elongata* Jørg.	..	..	r	..	..	r	..	..	..	r	..	..	r	r	
Dictyocysta templum Hck.	..	r													
D. t. v. *disticha* Jørg.	..	r	r	..	..	..	..	..	..	..	..	..	r		

Year 1899. Month	January										February						
Locality	Lyngen III, off Spokenes		Malangen, between Lysbotn and Stønnesbotn		Følstad, Østnesfjord		Helle, Østnesfjord		Hola, Svolvær		Henningsvær, 8 miles StW	Vestfjord, 8 miles SSE of Henningsvær		Skroven, 4 miles S	Raftsundet, off the Troldfjord	Raftsundet, between Aarsteen and Ulvaag	
Date	27/1	27/1	29/1	29/1	31/1	31/1	31/1	31/1	31/1	31/1	1/2	1/2	1/2	1/2	3/2	3/2	3/2
Depth (meters)	0—50	0—200	0—100	0—500	0—50	0—135	0—50	0—150	0—50	0—150	0—100	0—50	0—200	0—300	0—50	0—100	0—260
Salinity (‰)	32.60—33.87	32.60—33.94	33.92	33.92—34.52	33.25—33.58	33.25—34.52	33.25—33.44	33.25—34.59	33.25—33.37	33.25—34.59	—34.08			33.42—35.03	33.30—33.42	33.37—34.40	33.37—34.70
Temperature (Cels.)	1.8—3.4	1.8—2.9	2.8—2.9	2.8—5.5	2.5—4.3	2.5—6.8	2.1—3.8	2.1—6.7	2.1—3.8	2.1—6.8	—6.2			3.3—6.4	2.9—3.4	2.7—6.2	2.7—6.6
I. Bacillariales. *(Diatomaceæ).*																	
Rhizosolenia semispina HENS.	..	..	..	rr													
Biddulphia mobiliensis BAIL.	..	..	..	..	..	..	..	..	..	..	..	..	..	rr			
Chætoceros borealis BAIL.	..	..	..	..	..	..	..	..	..	..	..	..	..	r			
C. atlanticus CL.	..	r	..	..	..	..	..	..	..	..	..	..	..	r			
C. decipiens CL.	..	..	r	..	r												
C. Schüttii CL.	r	..	..	r+													
Actinocyclus Ehrenbergii RALFS	r	r	r	r+	r	r	..	r	..	r	..	..	r	..	r	.	
A. Ralfsii (W. SM.) RALFS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Coscinodiscus excentricus EHRB.	..	..	..	..	..	..	..	..	..	..	..	..	..	r			
C. radiatus EHRB.	r+	r	r+	+	r	..	..	r	..	..	r	r	r+	..	..	..	+
C. centralis EHRB.	+	r+	+	+	r+	r+	..	r+	..	r	+	+	+	r+	r+	+	+
Hyalodiscus stelliger BAIL.	r	r	r	r	..	..	..	r	..	..	..	..	r	r	..	..	r
H. subtilis BAIL.	..	..	..	r													
Thalassiothrix longissima CL. et GRUN.	..	..	..	rr													
F. Frauenfeldii GRUN.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
T. F. v. nitzschioides (GRUN.) JØRG.	..	r	..	r													
Pleurosigma tenerum JØRG. n. sp.	r	r	..	r	r	r											
Surirella lata W. SM.	..	..	r	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Campylodiscus Thuretii BRÉB.	..	..	..	r	..	..	..	..	..	..	..	..	..	r	..	r	r
C. angularis GREG.	..	..	..	r	..	..	..	..	..	..	..	..	..	..	..	..	r
Striatella unipunctata (LYNGB.) AG.	..	..	..	..	..	..	..	..	..	..	..	..	r				
Glyphodesmis Williamsonii (W. SM.) GRUN.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
II. Peridiniales. *(Dinoflagellata).*																	
Dinophysis acuta EHRB., JØRG.	r	r	..	r	..	..	..	..	..	..	r	..	..	..	..	r	r
D. norvegica CLAP. et LACHM. JØRG.	..	..	rr	..	..	..	..	..	..	..	..	..	..	..	..	r	r
D. rotundata CLAP. et LACHM.	..	rr															
Pyrophacus horologium STEIN	..	..	..	..	..	..	..	..	..	..	..	..	r				
Diplopsalis lenticula BERGH	..	r+	..	+	..	..	..	..	..	..	..	..	r+	..	..	r+	r
Peridinium depressum BAIL.	+	+	r+	+	+	+c	r+	+c	..	+	r+	+	c	+c	r	c	c
P. oceanicum VANHÖF.	..	..	r	r	..	..	..	..	..	r	..	..	r	r			
P. divergens EHRB. (*P. lenticulare* (EHRB.) JØRG.)	+	c	c	c	c	c	+	c	c	c	c	c	cc	cc	c	cc	cc
P. conicum (GRAN) OSTENF. et SCHM.	..	..	..	..	r	..	..	..	..	..	..	..	r				
P. pallidum OSTENF.	+	r+	+	+	..	r+	..	r+	..	..	r	..	+	..	r	r	+
P. Steinii JØRG.	..	..	..	r+	..	..	..	..	..	..	..	..	r	..	..	..	rr
P. ovatum (POUCH.) SCHÜTT	+c	..	+	+c	r	r	r	r+	..	r+	+	r	r+	r	..	r+	r
Ceratium tripos (O. F. MÜLL.) NITZSCH. (*α baltićum* SCHÜTT)	c	c	c	c	c	c	c	c	c	c	c	c	c	c	+	c	c

Year 1899. Month	January										February						
Locality	Lyngen III, off Spokenes		Malangen, between Lysbotn and Stønnesbotn		Følstad, Østnesfjord		Helle, Østnesfjord		Høla, Svolvær		Henningsvær, 8 miles StW	Vestfjord, 8 miles SSE of Henningsvær		Skroven, 4 miles S	Raftsundet, off the Troldfjord	Raftsundet, between Aarstenen and Ulvaeg	
Date	27/1	27/1	29/1	2/1	31/1	31/1	31/1	31/1	31/1	31/1	1/2	1/2	1/2	1/2	3/2	3/2	3/2
Depth (meters)	0—50	0—200	0—100	0—300	0—50	0—135	0—50	0—150	0—50	0—150	0—100	0—50	0—200	0—300	0—50	0—100	0—260
Salinity (‰)	32.60—33.87	32.60—33.94	33.92	33.92—34.52	33.25—33.58	33.25—34.52	33.25—33.44	33.25—34.50	33.25—33.37	33.25—34.59	—34.08			33.42—35.03	33.30—33.42	33.37—34.40	33.37—34.70
Temperature (Cels.)	1.8—3.4	1.8—2.9	2.8—2.9	2.8—5.5	2.5—4.3	2.5—6.8	2.1—3.8	2.1—6.7	2.1—3.3	2.1—6.8	—6.2			3.3—6.4	2.9—3.4	2.7—6.2	2.7—6.6
C. bucephalum Cl.	c	c	cc	c	c	c	c	cc	c	c	c	c	cc	cc	+	cc	cc
C. macroceros Ehrb.	+	+c	+c	+c	+c	+c	+c	+	+c	+c	+c	+c	+	+	+	c	+
C. intermedium Jørg.	+	+c	c	c	+c	+c	+c	+c	c	+	c	c	c	+c	+	c	+c
C. longipes (Bail.) Cl.	c	+c	+	+	+c	+	+	+c	+c	+	+c	+	+c	+	..	+	+
C. furca (Ehrb.) Duj.	c	+	r+	+c	+	c	+	+c	+c	+	+c	+c	+c	r	r+	+c	r+
C. lineatum (Ehrb.) Cl.	..	..	..	r	..	..	..	..	..	..	..	..	..	..	..	..	r
C. fusus (Ehrb.) Duj.	+c	c	c	c	c	c	c	c	c	c	c	c	c	+	r+	+c	c
III. Pterospermataceæ.																	
Pterosperma Möbii (Jørg.) Ostenf.	r+	+	r	+	r	r	r	r	..	r	r+	..	r	..	..	r	r
P. Vanhöffenii (Jørg.) Ostenf.	+c	+c	+c	+c	..	..	..	r+	..	..	r	r	..	..	r	+	+
P. dictyon (Jørg.) Ostenf.	+c	+c	+	+c	..	r	r	+	..	..	r+	r	+	r	r	+	+
IV. Halosphæraceæ.																	
Halosphæra viridis Schmitz (incl. *H. minor* Ostenf.)	c	c	cc	cc	cc	c	cc	cc	cc	c	cc	ccc	ccc	cc	+	cc	c
V. Silicoflagellata.																	
Distephanus speculum (Ehrb.) Støhr	..	..	..	..	..	..	..	..	..	..	..	..	..	r			
Dictyocha fibula Ehrb.	..	..	..	..	..	..	..	..	..	..	..	..	rr				
VI. Radiolaria.																	
1. Spumellaria.																	
Echinomma trinacrium Hck.	..	..	..	..	..	..	..	..	..	..	..	..	r	r			
C. leptodermum Jørg.	..	..	..	r	..	..	..	..	..	..	..	..	r	r			
Drymyomma elegans Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	r				
Chromyomma boreale (Cl.) Jørg.	..	..	..	r	..	..	..	..	..	..	..	..	r				
Rhizoplegma boreale (Cl.) Jørg.	..	..	..	r	..	..	..	..	..	..	r	..	r	r	..	..	r
Lithelius minor Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	r	r	..	..	r
Phorticium pylonium Hck.?, Cl.	..	..	..	..	..	..	..	..	..	..	..	..	r				
Sorolarcus circumtextus Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	r	..	..	r
2. Nassellaria.																	
Plagiacantha arachnoides Clap. et Lachm.	..	..	..	r	..	..	..	..	..	..	..	..	r	r			
Campylacantha cladophora Jørg. n. sp.	..	..	..	r	..	..	..	..	..	..	..	..	r	r			
Plectacantha oikiskos Jørg. n. sp.	..	..	..	r	..	..	..	..	..	..	..	..	r	r			
Phormacantha hystrix (Jørg.) Jørg.	..	..	..	r	..	..	..	..	..	..	..	..	r	r			
Gonosphæra primordialis Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	r	r			
Ceratospyris hyperborea Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	rr				

Year 1899. Month	January										February						
Locality	Lyngen III, off Spokenes		Malangen, between Lysbotn and Stønnesbotn		Følstad, Østnesfjord		Helle, Østnesfjord		Høla, Svolvær		Henningsvær, 8 miles StW	Vestfjord, 8 miles SSE of Henningsvær		Skroven, 4 miles S	Raftsundet, off the Troldfjord	Raftsundet, between Aarstenen and Ulvaag	
Date	27/1	27/1	29/1	29/1	31/1	31/1	31/1	31/1	31/1	31/1	1/2	1/2	1/2	1/2	3/2	3/2	3/2
Depth (meters)	0—50	0—200	0—100	0—300	0—50	0—135	0—50	0—150	0—50	0—150	0—100	0—50	0—200	0—300	0—50	0—100	0—260
Salinity (‰)	32.60—33.87	32.60—33.94	33.92	33.92—34.52	33.25—33.58	33.25—34.52	33.25—33.44	33.25—34.59	33.25—33.37	33.25—34.59	—34.08			33.42—35.03	33.30—33.42	33.37—34.40	33.37—34.70
Temperature (Cels.)	1.8—3.4	1.8—2.9	2.8—2.9	2.8—5.5	2.5—4.3	2.5—6.8	2.1—3.8	2.1—6.7	2.1—3.3	2.1—6.8	—6.2			3.3—6.4	2.9—3.4	2.7—6.2	2.7—6.6
Peridium longispinum JØRG.	..	..	..	r													
Euscenium corynephorum JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Cladoscenium tricolpium (HCK.?) JØRG.	..	..	..	..	..	..	..	r	..	..	..	..	r				
Helotholus histricosa JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	r	r	..	..	+
Dictyophimus Clevei JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r	rr			
Lithomelissa setosa (CL.) JØRG.	..	r	..	r	..	..	..	..	..	..	..	..	r	r	..	..	r
L. hystrix JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	rr	r	..	..	r
Acanthocorys umbellifera HCK.	..	..	..	r													
Dictyoceras xiphephorum JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r				
Clathrocyclas craspedota (JØRG.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r	r	..	..	r
Androcyclas gamphonycha (JØRG.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r	r+	..	..	r
3. *Phæodaria (Tripylea).*																	
Cannosphæra geometrica BORG.	..	..	..	..	..	..	..	..	..	..	..	..	r	r			
Protocystis xiphodon (HCK.) BORG.	..	..	..	r	..	..	..	..	..	..	..	..	r	r	..	..	r
P. Harstoni (MURRAY) BORG.	..	..	..	..	..	..	..	..	..	..	..	..	..	r			
P. tridens (HCK.) BORG.	..	r															
Challengeron diodon HCK. (*C. heteracanthum* JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r	r	..	..	r
Gazelletta pentapodium JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r				
VII. *Tintinnodea.*																	
Tintinnus acuminatus CLAP. et LACHM.	..	..	..	..	r	r	rr	r	..	..	..	..	r	..	r	r	
T. a. v. *undata* JØRG.	..	..	..	rr													
Amphorella ampla JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	rr				
Ptychocylis urnula (CLAP. et LACHM.) BRANDT α *major* JØRG.	..	..	..	r													
P. u. v. *minor* JØRG.	..	..	..	r	..	..	r	..	..	..	rr	r	r	r	r	r	
P. u. v. *subarctica* JØRG. n. var.	r	..	..	r													
Tintinnopsis nitida BRANDT	+	+	+	+c													
Cyttarocylis denticulata (EHRB.) FOL.	+	+	r	+	+	+	+c	c	+c	+	+	..	+c	r	r	+	+c
C. d. v. *cylindrica* JØRG.	..	..	..	r	r	+	..	+	..	+	.	..	..	..	..	+	+
C. d. v. *gigantea* (BRANDT) CL.	..	r															
C. d. v. *elongata* JØRG.	..	r	..	r+	r	r+	..	r+	..	r	r	..	r				
C. d. v. *subrotundata* JØRG.	..	r+	..	..	..	..	..	..	..	..	..	..	r	..	..	..	r
Dictyocysta templum HCK. v. *disticha* JØRG.	..	..	..	rr													
Undella caudata (OSTENF.) CL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr

Year 1899. Month	February															
Locality	Skroven, 5 miles ESE	Tranødybet, between Trano and Lødingen			Ofoten I, between Havnes and Ransund		Ofoten II, between Bogen and Ballangen		Rombaken I at the head,	Rambaken II, off Ytre Sildvik	Rombaken III, inside Øijord		Skjomen, at Elvegaard	Ofotenfjord, off Skarstad	Skroven, 5 miles SWtS	
Date	4/2	6/2	6/2	6/2	7/2	7/2	7/2	7/2	8/2	8/2	8/2	8/2	9/2	9/2	18/2	18/2
Depth (meters)	300—350	0—50	0—200	0—630	0—100	300—350	0—100	200—250	0—40	0—100	0—100	200—300	0—40	500—550	0—50	0—250
Salinity (‰)	35.14	33.50	33.50—35.03	33.50—35.14	33.30—34.08	35.08	33.30—34.21	34.89—34.96	33.18—33.25	33.25—33.37	33.30—34.01	34.70—34.82	33.37—33.42	35.14	33.01—33.56	33.61—35.08
Temperature (Cels.)	6.4	2.5—2.8	2.5—6.4	2.5—6.3	1.7—5.7	6.3	1.5—5.4	6.2	0.2—0.5	0.2—0.6	1.4—4.8	6.0	1.9—2.0	6.3	2.1—3.0	6.6
I. Bacillariales. (Diatomaceæ).																
Rhizosolenia styliformis Brightw.	r															
Biddulphia aurita (Lyngb.) Bréb.	..	..	..	rr	..	..	..	..	rr	r						
B. mobiliensis Bail.	rr															
Chætoceros borealis Bail.	r	..	r													
C. convolutus Castr.	..	..	..	..	..	..	rr	r	..	..	..	..	r			
C. decipiens Cl.	..	..	..	..	..	..	r	r	r							
C. contortus Schütt	r															
Ditylium Brightwellii (West) Grun.	r	..	r													
Thalassiosira gravida Cl.	..	..	..	..	..	..	..	..	..	rr						
Coscinosira polychorda (Gran) Gran	rr															
Actinocyclus Ehrenbergii Ralfs	..	..	..	..	..	..	r	..	r	..	r	r	r	..	r	r+
Coscinodiscus excentricus Ehrb.	+	..	..	..	..	r+	..	..	..	..	..	..	..	..	..	r
C. decipiens Grun.	rr															
C. lineatus Ehrb. var.	rr	..	..	..	..	..	..	..	r							
C. stellaris Rop.	rr															
C. radiatus Ehrb.	+	r	r	r+	r+	r	r+	r	r	r+	r	..	r	..	r	r
C. centralis Ehrb.	r+	r	+	r+	r+	..	r+	r	..	r	r	..	r	r	r	+
C. concinnus W. Sm.	r															
C. subbulliens Jørg. n. sp.	..	..	..	..	r	..	..	..	..	..	..	..	..	r		
Hyalodiscus stelliger Bail.	r	..	..	r	..	r	r									
Thalassiothrix longissima Cl. et Grun.	rr															
T. Frauenfeldii Grun.	rr	..	..	..	..	..	..	..	r	r	..	..	..	..	..	r
T. F. v. *nitzschioides* (Grun.) Jørg.	..	..	..	..	..	..	r									
T. F. v. *n. forma curvata* (Castr.) Jørg.	..	..	..	..	..	r	..	..	r							
Asterionella Bleakeleyi W. Sm.	r															
Auricula complexa (Greg) De T.	..	..	..	..	..	..	..	..	..	..	..	rr				
Pleurosigma tenerum Jørg. n. sp.	..	..	..	r	..	..	r+	r+	cc	c	+c	+	c	..	+	
Paralia sulcata (Ehrb.) Cl.	rr															
Actinoptychus undulatus (Bail.?) Ralfs	r	..	..	..	..	..	r									
Surirella lata W. Sm.	..	..	..	..	..	..	..	r	..	..	..	..	..	..	..	r
Campylodiscus Thuretii Bréb.	r	..	..	..	..	..	r	r	r+	r	r					
C. angularis Greg.	..	..	..	..	..	..	r	r	+	r+						
Rhabdonema arcuatum (Lyngb.) Kütz.	..	..	..	..	..	..	..	..	..	..	..	..	..	r		
II. Peridiniales. (Dinoflagellata).																
Dinophysis acuta Ehrb., Jørg.	r	..	r	..	r	r	r+	..	r	r	r+	+	r	..		r
D. norvegica Clap. et Lachm., Jørg.	r	..	..	..	..	..	..	..	..	..	..	..	r			
D. rotundata Clap. et Lachm.	..	..	..	..	..	..	rr	..	..	..	..	..	rr			

Year 1899. Month	February															
Locality	Skroven, 5 miles ESE	Tranedybet, between Tranø and Lødingen			Ofoten I, between Havnes and Bamsund		Ofoten II, between Bogen and Ballangen		Rombaken I, at the head	Rombaken II, off Ytre Sildvik	Rombaken III, inside Øijord		Skjomen, at Elvegaard	Ofotenfjord, off Skarstad	Skroven, 5 miles SW1/2S	
Date	4/2	6/2	6/2	6/2	7/2	7/2	7/2	7/2	8/2	8/2	8/2	8/2	9/2	9/2	13/2	13/2
Depth (meters)	300—350	0—50	0—200	0—630	0—100	300—350	0—100	200—250	0—40	0—100	0—100	200—300	0—40	500—550	0—50	0—250
Salinity (‰)	35.14	33.50	33.50—35.08	33.50—35.14	33.30—34.08	35.03	33.30—34.21	34.89—34.96	33.18—33.25	33.25—33.37	33.30—34.01	34.70—34.82	33.37—33.42	35.14	33.61—33.66	33.61—35.08
Temperature (Cels.)	6.4	2.6—2.8	2.5—6.4	2.5—6.3	1.7—5.7	6.3	1.5—5.4	6.2	0.2—0.5	0.2—0.6	1.4—4.8	6.0	1.9—2.0	6.3	2.1—3.0	6.6
Pyrophacus horologium Stein	..	..	..	..	..	..	r	r								
Diplopsalis lenticula Bergh	..	r	+	r	..	..	+	r	r	r	r+	..	r	r	..	r
Peridinium depressum Bail.	+	+c	cc	+c	+c	+c	r	cc	c	r+	+	+c	r+	+	r+	+
P. oceanicum Vanhøf.	..	..	r													
P. divergens Ehrb. (*P. lenticula* (Ehrb.) Jørg.)	c	c	c	+c	c	c	c	c	c	c	+	+c	+c	+c	r+	c
P. conicum (Gran) Ostenf. et Schm.	r	..	..	..	..	r	r									
P. pallidum Ostenf.	r	r	r+	+	+	+	+	+c	+	+	+	r+	r+	r+	..	r
P. Steinii Jørg.	..	..	r+	r	..	..	+	r	..	..	r+	..	r			
P. ovatum (Pouch.) Schütt.	+	..	r	r	+	+c	+c	c	+c	..	r+	+	..	..	..	r
Ceratium tripos (O. F. Müll.) Nitzsch. (α *balticum* Schütt)	c	c	c	+c	+c	+c	c	c	c	+c	c	r	+	+	+c	c
C. bucephalum Cl.	+	cc	cc	c	c	c	c	c	c	c	c	+	c	+	+c	c
C. macroceros Ehrb.	c	+	c	+	+	+	c	+	+	+	+c	..	r	r	+	r
C. intermedium (Jørg.)	c	c	c	+c	r+	+	+	+	r+	..	+	..	..	+	+	+
C. longipes (Bail.) Cl.	+	+c	+c	+	c	+c	c	c	cc	cc	cc	+	c	+c	+c	+c
C. furca (Ehrb.) Duj.	r	+	+c	r	r+	+	+c	+	+	r+	+	..	r	..	+	r
C. lineatum (Ehrb.) Cl.	r															
C. fusus (Ehrb.) Duj.	+c	c	c	+c	r+	+	c	c	r	c	c	..	c	+c	c	c
III. Pterospermataceæ.																
Pterosperma Möbii (Jørg.) Ostenf.	..	r	r	..	r	..	r+	..	r	r	r+	..	..	..	..	r
P. Vanhöffeni (Jørg.) Ostenf.	r	r	..	..	r	r	r	r	r	r	+	r	r	..	r	
P. dictyon (Jørg.) Ostenf.	+	r+	r+	r+	+	..	+c	r	+c	+c	c	r	r	r	r	r+
IV. Halosphæraceæ.																
Halosphæra viridis Schmitz (incl. *H. minor* Ostenf.)	c	c	cc	c	cc	+c	c	c	c	c	cc	c	+c	c	c	cc
V. Silicoflagellata.																
Distephanus speculum (Ehrb.) Støhr	r															
Dictyocha fibula Ehrb.	r	..	..	..	..	..	r									
VI. Radiolaria.																
1. Spumellaria.																
Hexacontium enthacanthum Jørg.	r	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
H. pachydermum Jørg.	r	..	..	..	..	..	..	..	..	..	..	..	..	r		
Echinomma trinacrium Hck.	..	..	..	..	..	..	r	r	..	..	..	..	..	r	..	r
E. leptodermum Jørg.	r	..	..	r+	..	..	r	..	r							
Drymyomma elegans Jørg.	r															
Chromyomma boreale (Cl.) Jørg.	..	..	..	r	..	..	..	..	..	..	..	..	..	rr	..	r

Year 1899. Month	February															
Locality	Skroven, 5 miles ESE	Tranødybet, between Trane and Lødingen			Ofoten I, between Havnes and Ramsund		Ofoten II, between Bogen and Ballangen		Rombaken I, at the head	Rombaken II, off Ytre Sildvik	Rombaken III, inside Øifjord		Skjomen, at Elvegaard	Ofotenfjord, off Skarstad	Skroven, 5 miles SW½S	
Date	4/2	6/2	6/2	6/2	7/2	7/2	7/2	7/2	8/2	8/2	8/2	8/2	9/2	9/2	18/2	18/2
Depth (meters)	300—350	0—50	0—200	0—630	0—100	300—350	0—100	200—250	0—40	0—100	0—100	200—300	0—40	500—550	0—50	0—250
Salinity (⁰/₀₀)	35.14	33.50	33.50—35.03	33.50—35.14	33.30—34.08	35.03	33.30—34.21	34.89—34.96	33.18—33.25	33.25—33.37	33.30—34.01	34.70—34.82	33.37—33.42	35.14	33.61—33.56	33.61—35.08
Temperature (Cels.)	6.4	2.5—2.8	2.5—6.4	2.5—6.3	1.7—5.7	6.3	1.5—5.4	6.2	0.2—0.5	0.2—0.6	1.4—4.8	6.0	1.9—2.0	6.3	2.1—8.0	6.6
Rhizoplegma boreale (Cl.) Jørg.	r	..	r	r+	..	..	r	r	r	r	..	..	r			
Lithelius minor Jørg.	r	..	..	r	..	..	..	..	..	..	..	..	..	..	..	r
Phorticium pylonium Hck.? Cl.	..	..	..	..	..	..	r									
Sorolarcus circumtextus Jørg.	r															
2. *Nassellaria.*																
Plagiacantha arachnoides Clap. et Lachm.	r	..	..	r	..	..	r	r	..	r						
Campylacantha cladophora Jørg. n. sp.	r	..	..	r	..	..	r	r	..	..	..	..	..	..	..	r
Plectacantha oikiskos Jørg. n. sp.	r	..	..	..	..	..	r	r								
Phormacantha hystrix (Jørg.) Jørg.	r	..	..	r	..	..	r	r	..	..	..	..	..	..	..	r
Gonosphæra primordialis Jørg. n. sp.	r	..	..	..	..	..	..	r	..	..	..	..	r			
Peridium longispinum Jørg.	..	..	..	..	..	..	..	r								
Cladoscenium tricolpium (Hck.)? Jørg.	r															
Helotholus histricosa Jørg. n. sp.	r	..	..	r+	..	..	r+	r	r	..	..	..	..	r	..	r
Dictyophimus Clevei Jørg.	..	..	..	..	..	..	rr									
Lithomelissa setosa (Cl.) Jørg.	r	..	r	r	..	r	r	r+	..	..	..	..	..	..	..	r
Dictyoceras xiphephorum Jørg.	..	..	..	r	..	..	r									
Clathrocyclas craspedota (Jørg.) Jørg.	r	..	..	r	..	r	r	r	..	r	..	..	..	r	..	r
Androcyclas gamphonycha (Jørg.) Jørg.	r+	..	+	+c	..	r	r	r	r	r	..	..	..	r+	..	r
A. amblycephalis (Jørg.) Jørg.	r	..	..	..	..	..	r	r	r	r	..	..	..	r		
Stichocorys seriata (Jørg.) Jørg.	..	..	..	r+	..	..	..	..	..	..	..	..	..	r		
3. *Phæodaria (Tripylea).*																
Protocystis xiphodon (Hck.) Borg.	r	..	..	r	..	..	..	r	..	..	..	..	..	..	..	r
P. Harstoni (Murray) Borg.	r	..	..	+	..	r	..	..	..	..	..	..	..	r		
P. tridens (Hck.) Borg.	r	..	..	..	..	..	r+	r								
Challengeron diodon Hck. (*C. heteracanthum* Jørg.)	r	..	r	r+	..	r	..	r	..	..	..	r	..	r	..	r
Medusetta arcifera Jørg.	..	..	..	..	..	..	..	r								
VII. *Tintinnodea.*																
Tintinnus acuminatus Clap. et Lachm.	..	..	..	..	rr	..	..	rr	..	r	..	..	r	..	..	rr
Leprotintinnus pellucidus (Cl.) Jørg.	..	..	..	..	..	..	..	..	rr							
Ptychocylis urnula (Clap. et Lachm.) Brandt α *major* Jørg.	..	..	..	..	..	..	r									
P. u. v. *minor* Jørg.	..	..	..	r	..	r	r	r	r	r	r	+	r	r	..	r
P. u. v. *digitalis* Auriv.	..	..	..	..	..	..	r	r	r	r						
P. u. v. *subarctica* Jørg. n. var.	..	..	rr													
Tintinnopsis nitida Brandt	..	..	..	..	r	..	rr	..	+c	+c	..	..	r+	..	r	r
Cyttarocylis denticulata (Ehrb.) Fol.	..	r	+r	r	r+	r	+c	+c	r	c	+c	r+	r	..	r	r
C. d. v. *elongata* Jørg.	..	..	..	..	..	..	..	..	..	+c	..	..	..	r		
C. d. v. *subrotundata* Jørg.	..	..	..	..	..	r	..	r	..	r						
C. d. v. *subedentata* Jørg. n. var.	..	..	..	..	..	..	+c	+c	+c	+c	+c					
Undella caudata (Ostenf.) Cl.	..	..	..	..	..	..	r	..	r	..	r+	r	r	r		

Year 1899. Month	February											March				
Locality	Strømmen I, at Henningsvær	Strømmen II, at Henningsvær	Mouth of the Raftsund	Øxsund, between Hammerø and Lundø			Sagfjord I, inside Furunesveggen		Sagfjord II, outside F.	Henningsvær I, 4 miles SSW	Henningsvær III, 16 miles SSW	Evenstad I, 7 miles SE of Lofotodden	Evenstad II, 10 miles SE of Lofotodden	Kirkfjord I, inside Vorfjorden	Reine I, 11 miles SE	
Date	13/2	13/2	16/2	17/2	17/2	17/2	18/2	18/2	18/2	21/2	21/2	1/3	1/3	3/3	4/3	4/3
Depth (meters)	0—80	0—30	0—275	0—100	250—350	550—620	0—50	0—200	0—300	0—85	0—250	0—50	0—200	0—100	0—50	0—150
Salinity (‰)	33.56—33.74	33.56—34.42		33.23—34.19	34.04—35.08	35.08	33.48—34.16	33.48—34.89		33.52—34.02	33.52—35.03	34.06—34.21	33.80—34.07	33.16—33.48	33.54—33.61	33.54—34.70
Temperature (Cels.)	2.2—3.4	1.7		1.1—6.4	6.6—6.5	6.3	2.7—6.1	2.7—6.4		2.0—4.2	2.0—6.6	3.0—4.3	2.8—6.6	2.0—2.7	2.1—2.5	2.1—6.7
I. Bacillariales. *(Diatomaceæ).*																
Biddulphia aurita (LYNGB.) BRÉB.	..	..	..	..	..	..	..	..	..	..	..	..	r+			
B. mobiliensis BAIL.	..	..	..	..	..	..	..	..	..	..	r					
Chætoceros borealis BAIL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
C. atlanticus CL.	..	..	..	rr	..	..	..	..	..	..	rr					
C. decipiens CL.	..	..	..	..	..	..	r	r								
C. debilis CL.	..	..	..	..	..	..	..	..	..	..	..	..	rr			
Thalassiosira gravida CL.	..	..	..	..	..	..	..	..	..	..	..	..	r			
Coscinosira polychorda (GRAN) GRAN	..	..	..	..	..	..	r	r	..	..	..	..	r			
Actinocyclus Ehrenbergi RALFS	r	..	..	r	..	..	r	r	..	..	r	r	+c	r	r+	r+
Roperia tessellata (ROP.) GRUN.	..	..	..	..	..	..	..	..	..	..	r					
Coscinodiscus excentricus EHRB.	..	r	..	r	..	r	r	r	..	..	r	..	r	..	..	r
C. lineatus EHRB. var.	..	..	..	..	..	..	..	..	..	..	r					
C. stellaris ROP.	..	..	..	..	..	..	..	..	..	..	rr	..	r			
C. radiatus EHRB.	..	..	r	..	..	..	..	..	..	r	r+	+	+c	+	+c	c
C. subbulliens JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	r+			
C. centralis EHRB.	r	r	r	r	r	..	r	r	r	r+	r+	+	+c	c	+	
C. concinnus W. SM.	..	..	..	r												
Hyalodiscus stelliger BAIL.	..	..	..	..	..	r	..	..	r	..	r	..	r	r		
Thalassiothrix longissima CL. et GRUN.	r	..	..	r												
T. Frauenfeldii GRUN. v. *nitzschioides* (GRUN.) JØRG.	..	..	..	..	..	..	r	r								
Pleurosigma tenerum JØRG. n. sp.	..	..	..	r	..	..	r	r								
Actinoptychus undulatus (BAIL.?) RALFS	..	..	..	..	..	..	..	..	..	..	..	..	r			
Surirella lata W. SM.	..	..	..	..	..	r	..	..	..	..	..	..	r			
Campylodiscus Thuretii BRÉB.	r	..	r	r	..	..	..	..	..	..	..	..	..	r		
C. angularis GREG.	..	..	r	..	..	..	..	..	r							
Grammatophora oceanica EHRB.	..	..	..	..	..	..	..	..	..	..	..	..	r			
Rhabdonema arcuatum (LYNGB.) KÜTZ.	..	..	..	..	..	..	..	..	..	..	r					
Auliscus sculptus (W. SM.) RALFS	..	..	r													
II. Peridiniales. *(Dinoflagellata).*																
Dinophysis acuta EHRB., JØRG.	..	..	..	r	..	..	r	r	r	..	r	r	r			
D. norvegica CLAP. et LACHM., JØRG.	..	..	..	..	..	..	r	..	..	..	..	..	r	r		
D. rotundata CLAP. et LACHM.	..	..	..	..	..	..	r	r								
D. r. v. *lævis* (CLAP. et LACHM.) JØRG.	..	..	..	..	..	..	r									
Diplopsalis lenticula BERGH	r	..	r	+	..	..	r	+	..	..	r					
Peridinium depressum BAIL.	r+	rr	+	c	+	+	+	c	c	..	c	r+	r	+	r	+c
P. oceanicum VANHÖF.	..	rr	..	r	..	..	r	r	r	..	r					
P. divergens EHRB. (*P. lenticulare* (EHRB.) JØRG.)	+	r+	c	cc	+	+	cc	c	cc	c	c	c	c	+	c	c

Year 1899. Month	February											March				
Locality	Strømmen I, at Henningsvær	Strømmen II, at Henningsvær	Mouth of the Raftsund	Øxsund, between Hammerø and Lundø			Sagfjord I, inside Furunesveggen		Sagfjord II, outside F.	Henningsvær I, 4 miles SSW	Henningsvær III, 16 miles SSW	Evenstad I, 7 miles SE af Lofotodden	Evenstad II, 10 miles SE of Lofotodden	Kirkfjord I, inside Vorfjorden	Reine I, 11 miles SE	
Date	13/2	13/2	16/2	17/2	17/2	17/2	18/2	18/2	18/2	21/2	21/2	1/3	1/3	3/3	4/3	4/3
Depth (meters)	0—80	0—30	0—275	0—100	250—350	550—620	0—50	0—200	0—300	0—85	0—250	0—50	0—200	0—100	0—50	0—150
Salinity (‰)	33.56—33.74	33.56—33.42		33.23—34.19	34.94—35.08	35.08	33.48—34.16	33.48—34.89		33.62—34.02	33.52—35.03	34.06—34.21	33.80—34.97	33.16—33.48	33.54—33.61	33.54—34.70
Temperature (Cels.)	2.2—3.4	1.7		1.1—6.4	6.6—6.5	6.3	2.7—6.1	2.7—6.4		2.6—4.2	2.6—6.6	3.0—4.3	2.8—6.6	2.0—2.7	2.1—2.5	2.1—6.7
Peridinium conicum (Gran) Ostenf. et Schm.	..	..	..	..	..	..	..	..	..	..	r					
P. pallidum Ostenf.	..	..	r	+	..	..	r	+c	+	..	r	..	r	..	..	r
P. Steinii Jørg.	r	..	r	+	..	..	rr	+r	r	..	..	..	r			
P. ovatum (Pouch.) Schütt.	r	r	r	+	..	..	r	r+	r	..	r+	..	r			
Ceratium tripos (O. F. Müll.) Nitzsch. (α *balticum* Schütt.)	c	+c	c	c	..	..	+	r	+	c	cc	c	c	c	c	c
C. bucephalum (Cl.) Cl.	c	c	c	c	..	..	+	r	+	c	c	c	c	c	c	c
C. macroceros (Ehrb.) Cl.	+c	+	r	+c	..	..	+	+	+	+	c	c	c	c	+	c
C. intermedium (Jørg.) Jørg.	+	+r	r	+c	..	..	+	r	+	+c	+	c	c	+c	c	c
C. longipes (Bail.) Cl.	+c	c	c	c	..	..	r+	r	+	c	c	c	c	c	c	c
C. arcticum (Ehrb.) Cl.	..	r														
C. furca (Ehrb.) Duj.	+	+	+c	+c	+	..	c	+	+	+	cc	+c	c	+c	+c	c
C. lineatum (Ehrb.) Cl.	..	..	r													
C. fusus (Ehrb.) Duj.	c	c	c	c	+	..	c	c	c	c	+c	c	c	c	c	c
III. Pterospermataceæ.																
Pterosperma Möbii (Jørg.) Ostenf.	r+	r	r	r	..	..	r	..	..	r	..	r	r+	r+	r	r
P. Vanhöffeni (Jørg.) Ostenf.	r+	r+	r	r	..	..	r	r	..	r+	..	..	+	r+	r+	+
P. dictyon (Jørg.) Ostenf.	r+	+	+	r+	..	..	r	r	r	r+	..	r+	+	c	c	c
IV. Halosphæraceæ.																
Halosphæra viridis Schmitz. (incl. *H. minor* Ostenf.)	cc	cc	c	c	+	..	+	+	+c	cc	cc	+	c	c	cc	c
V. Silicoflagellata.																
Dictyocha fibula Ehrb.	..	..	..	..	..	..	..	..	..	..	..	..	r			
VI. Radiolaria.																
1. Spumellaria.																
Hexacontium enthacanthum Jørg.	..	..	..	..	..	..	..	..	..	..	r					
H. pachydermum Jørg.	..	..	..	..	..	r										
Echinomma trinacrium Hck.	..	..	..	..	..	..	rr	..	..	..	r					
E. leptodermum Jørg.	..	..	r	..	r	r	..	..	..	..	r	r	r			
Chromyomma boreale (Cl.) Jørg.	..	..	..	..	..	r										
Rhizoplegma boreale (Cl.) Jørg.	..	..	..	..	..	r	..	..	r	..	r	..	r			
Lithelius minor Jørg.	..	..	..	..	..	..	..	..	r	..	r	..	r			
Phorticium pylonium Hck.?, Cl.	..	..	..	..	r	r	..	..	..	..	..	..	r			

Year 1899. Month	February											March				
Locality.	Strømmen I, at Henningsvær	Strømmen II, at Henningsvær	Mouth of the Raftsund	Øxsund, between Hammerø and Lundø			Sagfjord I, inside Furunesveggen		Sagfjord II, outside F.	Henningsvær I, 4 miles SSW	Henningsvær III, 16 miles SSW	Evenstad I, 7 miles SE of Lofotodden	Evenstad II, 10 miles SE of Lofotodden	Kirkfjord I, inside Vorfjorden	Reine I, 11 miles SE	
Date	13/2	13/2	16/2	17/2	17/2	17/2	18/2	18/2	18/2	21/2	21/2	1/3	1/3	3/3	4/3	4/3
Depth (meters)	0—80	0—30	0—275	0—100	250—350	550—620	0—50	0—200	0—300	0—85	0—250	0—50	0—200	0—100	0—50	0—150
Salinity (‰)	33.56—33.74	33.56—33.42		33.23—34.19	34.94—35.08	35.08	33.48—34.16	33.48—34.89		33.52—34.02	33.52—35.03	34.00—34.21	33.80—34.97	33.16—33.48	33.54—33.61	33.34—34.70
Temperature (Cels.)	2.2—3.4	1.7		1.1—6.4	6.0—6.5	6.3	2.7—6.1	2.7—6.4		2.6—4.2	2.6—6.6	3.9—4.3	2.8—6.6	2.0—2.7	2.1—2.5	2.1—6.7
2. Acantharia.																
Radiosphæra anacanthica JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	r				
3. Nassellaria.																
Plagiacantha arachnoides CLAP. et LACHM.	..	..	..	r	..	..	..	..	..	..	r					
Campylacantha cladophora JØRG. n. sp.	..	..	..	..	r	r	..	..	r							
Plectacantha oikiskos JØRG. n. sp.	..	..	..	..	..	r	..	..	..	..	rr					
Phormacantha hystrix (JØRG.) JØRG.	..	..	..	..	r	r	..	..	r	..	r	.	r			
Gonosphæra primordialis JØRG. n. sp.	..	..	..	..	r	r	..	..	..	..	r					
Peridium longispinum JØRG.	..	..	..	..	..	r										
Cladoscenium tricolpium (HCK.?) JØRG	..	..	..	r	r	..	..	..	..	..	rr					
Helotholus histricosa JØRG. n. sp.	..	..	r	..	r	r	..	..	r	..	r					
Dictyophimus Clevei JØRG.	..	..	..	..	r											
D. histricosus JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	rr					
Lithomelissa setosa (CL.) JØRG.	..	..	..	r	r	..	r	r	r	r	rr	..	r			
Dictyoceras acanthicum JØRG.	..	..	..	r	..	..	..	..	..	..	r					
Clathrocyclas craspedota (JØRG.) JØRG.	..	..	..	r	r	..	..	..	r	..	r					
Androcyclas gamphonycha (JØRG.) JØRG.	..	..	..	r	r	r+	..	..	r							
A. amblycephalis (JØRG.) JØRG.	..	..	..	..	..	r										
Stichocorys seriata (JØRG.) JØRG.	..	..	..	..	r											
4. Phæodaria (Tripylea).																
Cannosphæra lepta JØRG.	..	..	..	..	..	..	..	..	..	..	rr					
Protocystis xiphodon (HCK.) BORG.	..	..	..	..	r	r	..	..	r	..	rr					
P. Harstoni (MURRAY) BORG.	..	..	..	..	..	r										
P. tridens (HCK.) BORG.	r	..	..	r	r											
Challengeron diodon HCK. (*C. heteracanthum* JØRG.)	..	..	r	..	r	..	rr	..	..	..	r	..	r			
VII. *Tintinnodea.*																
Tintinnus acuminatus CLAP. et LACHM.	..	..	..	..	..	..	r	r								
Ptychocylis urnula (CLAP. et LACHM.) BRANDT v. *minor* JØRG.)	r	r	..	r	r	..	..	..	..	..	..	..	r	r	r	
Tintinnopsis nitida BRANDT	r	..	..	..	..	..	r	r	r	..	..	..	..	r		
Codonella lagenula (CLAP. et LACHM.) *Entz.* v. *ovata* JØRG.	r															
Cyttarocylis denticulata (EHRB.) FOL.	..	r+	+	+	+	r	r	r	r	..	r	r	r	r	r	r
C. d. α typica JØRG.	r															
C. d. v. *cylindrica* JØRG.	r+															
C. d. v. *elongata* JØRG.	..	..	..	..	..	r										
C. d. v. *subrotundata* JØRG.	r	..	..	..	..	..	..	..	r	..	..	..	..	r		
Dictyocysta templum HCK. v. *disticha* JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	..	r		
Undella caudata (OSTENF.) CL.	..	..	..	..	..	..	r	r	r							

Year 1899 Month	March														
Locality	Ure I, 9½ miles SSE	Henningsvær I, 6 miles SWtW½W	Raftsund	Risværflaket, outside the Øgsfjord	Kanstadfjord III, inside the ridge	Øgsfjord I, at the head	Øgsfjord II, at Halvorsø	Tranødybet, between Tranø and Lødingen				Henningsvær II, 6 miles StE½E	Være, 7 miles StW of Maahornet	Røsthavet, 60 miles NW of Røst	
Date	6/3	6/3	10/3	10/3	11/3	14/3	14/3	16/3	16/3	16/3	16/3	20/3	21/3	22/3	22/3
Depth (meters)	0—200	0—140	0—45	0—50	0—90	0—90	0—200	0	0—50	300—200	600—500	0—280	0—170	0—100	0—900
Salinity (‰)	—34.07	33.54—34.53	33.21—33.59	33.21—33.35	—33.48	32.54—33.10	32.95—33.33	33.41	33.41—33.84	35.00	35.00	33.67—35.06	34.10—35.06	35.00—35.31	35.00—35.00
Temperature (Cels.)	2.6—6.8	2.1—6.2	2.8—3.1	1.2—1.3	—1.6	2.1—2.1	1.3—1.4	1.4	1.4—3.0	6.5	6.5	1.7—6.55	3.2—6.8	5.05—6.4	5.05—1.1
I. Bacillariales. *(Diatomaceæ).*															
Chætoceros borealis BAIL.	..	..	..	..	r	..	rr	r	r	..	..	+	r+		
C. densus (CL.) CL.	..	..	..	..	..	..	..	..	..	..	..	r	r		
C. atlanticus CL.	..	..	..	..	..	..	.	r	r	..	..	r	r	r	r
C. decipiens CL.	..	..	..	..	..	..	rr	..	r	..	..	r	r		
C. contortus SCHÜTT	..	..	..	..	..	..	..	..	..	..	r				
Ditylium Brightwellii (WEST.) GRUN.	..	..	..	..	..	..	..	..	..	..	..	rr	..	r	r
Actinocyclus Ehrenbergii RALFS.	+	r+	r	..	r	r	..	..	r	r	..	r+	+	r	r+
Coscinodiscus excentricus EHRB.	..	r+	..	..	..	..	..	..	..	..	..	r+	r	..	r
C. curvatulus GRUN.	..	..	..	..	..	..	..	..	..	..	..	rr			
C. stellaris ROP.	..	..	..	..	..	..	..	..	..	..	..	r			
C. radiatus EHRB.	c	+c	..	..	r+	r	r	..	r+	..	..	+c	c	c	+c
C. subbulliens JØRG.	..	..	..	..	..	..	..	..	..	..	..	r	r	..	r+
C. centralis EHRB.	+c	+c	r	r	+	..	r	+	c	..	..	c	c	c	+c
Euodia gibba BAIL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Hyalodiscus stelliger BAIL.	..	r	..	..	..	..	r	..	..	..	..	..	r	..	r
Thalassiothrix Frauenfeldii GRUN. v. *nitzschioides* (GRUN.) JØRG.	..	..	..	..	..	..	r								
Pleurosigma tenerum JØRG. n. sp.	..	..	r	..	r	r	+								
Paralia sulcata (EHRB.) CL.	..	..	..	..	..	r	..	..	..	..	..	..	..	r	
Actinoptychus undulatus (BAIL.?) RALFS	..	..	..	..	..	..	..	..	..	..	..	r	r	r	r
Campylodiscus Thuretii BRÉB.	..	..	..	..	..	r	r+								
C. angularis GREG.	..	..	..	..	..	r	r								
Rhabdonema minutum KÜTZ.	..	..	..	..	r										
Striatella unipunctata (LYNGB.) AG.	..	..	..	..	..	..	r								
Auliscus sculptus (W. SM.) RALFS.	..	..	r												
II. Peridiniales. *(Dinoflagellata).*															
Dinophysis acuta EHRB., JØRG.	r	r	..	..	r	..	..	..	..	r	..	r	+	r	r
D. norvegica CLAP. et LACHM., JØRG.	r	..	..	..	..	..	..	..	..	..	..	..	r		
D. rotundata CLAP. et LACHM.	..	..	..	..	..	..	..	..	rr						
Pyrophacus horologium STEIN	..	..	..	..	..	..	..	..	..	..	..	rr	r		
Gonyaulax spinifera (CLAP. et LACHM.) DIES.	..	..	..	..	..	r									
Diplopsalis lenticula BERGH	+r	r	..	r	+	r+	r+	..	..	..	..	+	+	r	r
Peridinium depressum BAIL.	+	+c	r	+	+r	+	+	+	c	+	+	+c	c	r+	+
P. oceanicum VANHÖF.	rr														
Peridinium divergens EHRB. (*P. lenticulare* (EHRB.) JØRG.)	c	c	c	c	c	c	c	c	c	+	+	c	c	c	+
P. conicum (GRAN) OSTENF. et SCHM.	rr	..	..	..	..	..	..	..	..	r					

Year 1899. Month	March														
Locality	Ure I, 9½ miles SSE	Henningsvær I, 6 miles SWtW½W	Raftsund	Risværflaket, outside the Øgsfjord	Kanstadfjord III, inside the ridge	Øgsfjord I, at the head	Øgsfjord II, at Halvorsø	Tranødybet, between Tranø and Lødingen				Henningsvær II, 6 miles StE½E	Være, 7 miles StW of Maahornet	Røsthavet, 60 miles NW of Røst	
Date	6/3	6/3	10/3	10/3	11/3	14/3	14/3	16/3	16/3	16/3	16/3	20/3	21/3	22/3	22/3
Depth (meters)	0—200	0—140	0—45	0—50	0—90	0—90	0—200	0	0—50	300—200	600—500	0—280	0—170	0—100	0—900
Salinity (‰)	—34.97	33.54—34.53	33.21—33.59	33.21—33.35	—33.48	32.54—33.10	32.95—33.33	33.41	33.41—33.84	35.00	35.00	33.67—35.06	34.10—35.06	35.00—35.31	35.00—35.00
Temperature (Cels.)	2.0—6.8	2.1—6.2	2.3—3.1	1.2—1.8	—1.6	2.1—2.1	1.3—1.4	1.4	1.4—3.0	6.5	6.5	1.7—6.55	3.2—6.8	5.05—6.4	5.05—1.1
P. pallidum OSTENF.	r	+	..	r+	+	..	..	..	r+	..	..	r+	r		
P. Steinii JØRG.	..	r	r	r	r	rr									
P. ovatum (POUCH.) SCHÜTT	r	r+	r	..	r	..	..	..	+	..	..	r+	r		
Ceratium tripos (O. F. MÜLL.) NITZSCH. (*a balticum* SCHÜTT.)	c	c	+	+	c	+	+	+r	c	..	r	c	cc	cc	c
C. bucephalum CL.	c	c	+	+	c	+	+	c	c	r	+	c	c	c	+
C. macroceros EHRB.	c	+c	r	r	+	+	+	+	+c	..	+	c	c	+c	+
C. intermedium (JØRG.)	c	c	..	..	c	..	r	..	..	r	+	r	c	c	r
C. longipes (BAIL.) CL.	c	+	+	+	c	+c	+c	c	c	r	..	cc	cc	+c	
C. arcticum (EHRB.) CL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+r
C. furca (EHRB.) DUJ.	c	r+	r	+c	+c	r+	r	r+	r	..	r	+	c	cc	+
C. lineatum (EHRB.) CL.	..	r													
C. fusus (EHRB.) DUJ.	c	c	+	c	c	+	+	+	+c	r+	+	+	c	+c	+
III. Pterospermataceæ.															
Pterosperma Möbii (JØRG.) OSTENF.	+r	r	r	r+	r	r	+	r	..	..	..	r+			
P. Vanhöffeni (JØRG.) OSTENF.	c+	+	+	r+	+	+	+	+	+	..	..	+c	r	+	+
P. dictyon (JØRG.) OSTENF.	c	+	c	+	+	c	c	+c	c	..	..	c			
IV. Halosphæraceæ.															
Halosphæra viridis SCHMITZ (incl. *H. minor* OSTENF.)	cc	cc	c	+	+	c	c	c	ccc	+	+	..	r	r	
V. Silicoflagellata.															
Distephanus speculum (EHRB.) STØHR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Dictyocha fibula EHRB.	..	..	..	..	..	..	..	..	..	..	..	..	r	..	r
VI. Radiolaria.															
1. Spumellaria.															
Hexacontium enthacanthum JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
H. pachydermum JØRG.	..	..	..	..	..	..	..	..	..	..	..	r			
Echinomma leptodermum JØRG.	..	..	..	..	..	..	..	..	..	..	..	r	..	..	r
Chromyomma boreale (CL.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Rhizoplegma boreale (CL.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	r	..	r	r
Stylodictya validispina JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
S. aculeata JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
S. tenuispina JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Spongodiscus favus EHRB.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Lithelius minor JØRG.	..	..	..	..	..	..	..	..	..	..	..	r	..	..	r
Phorticium pylonium HCK.? CL.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r

Year 1899. Month	March														
Locality	Ure I, 9½ miles SSE	Henningsvær I, 6 miles SWtW½W	Raftsund	Risværflaket, outside the Øgsfjord	Kanstadfjord III, inside the ridge	Øgsfjord I, at the head	Øgsfjord II, at Halvorsø	Tranødybet, between Tranø and Lødingen				Henningsvær II, 6 miles StE½E	Være, 7 miles StW of Mashornet	Røstlavet, 60 miles NW of Røst	
Date	6/3	9/3	10/3	10/3	11/3	14/3	14/3	16/3	16/3	16/3	16/3	20/3	21/3	22/3	22/3
Depth (meters)	0—200	0—140	0—45	0—50	0—90	0—90	0—200	0	0—50	300—200	600—500	0—280	0—170	0—100	0—900
Salinity (‰)	—34.97	33.54—34.53	33.21—33.59	33.21—33.35	—33.48	32.54—33.10	32.95—33.33	33.41	33.41—33.84	35.00	35.00	33.67—35.06	34.10—35.06	35.00—35.31	35.00—35.00
Temperature (Cels.)	2.6—6.8	2.1—6.2	2.3—3.1	1.2—1.3	—1.6	2.1—2.1	1.3—1.4	1.4	1.4—3.0	6.5	6.5	1.7—6.55	3.2—6.8	5.05—6.4	5.05—1.1
2. *Nassellaria.*															
Plagiacantha arachnoides Clap. et Lachm.	..	..	..	..	..	..	..	..	..	..	..	r	..	..	r
Campylacantha cladophora Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Plectacantha oikiskos Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	r			
Phormacantha hystrix (Jørg.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Dictyocircus clathratus Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	rr			
Peridium longispinum Jørg.	rr	..	..	..	..	..	..	..	..	..	..	r	..	..	r
Euscenium corynephorum Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Cladoscenium tricolpium (Hck.?) Jørg.	..	..	..	..	..	..	..	..	..	..	..	r	..	r	r
Helotholus histricosa Jørg. n. sp.	..	..	..	..	..	..	..	..	..	..	..	r			
Dictyophimus Clevei Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Lithomelissa setosa (Cl.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	r	..	..	r
L. hystrix Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Dictyoceras xiphephorum Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Clathrocyclas craspedota (Jørg.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Androcyclas gamphonycha (Jørg.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
A. amblycephalis (Jørg.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Stichocorys seriata (Jørg.) Jørg.	..	..	..	..	..	..	..	..	..	..	..	r	..	..	r
3. *Phæodaria (Tripylea).*															
Protocystis xiphodon (Hck.) Borg.	..	r	..	..	..	..	..	..	..	..	..	..	..	..	r
P. Harstoni (Murray) Borg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
P. tridens (Hck.) Borg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
Challengeron diodon Hck. (*C heteracanthum* Jørg.)	..	..	..	..	..	..	..	..	..	..	..	r			
Gazelletta pentapodium Jørg.	..	..	..	..	..	..	..	..	..	..	..	r+			
Cadium melo (Cl.) Borg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	r
VII. *Tintinnodea.*															
Tintinnus acuminatus Clap. et Lachm.	..	..	..	..	..	rr	..	..	..	..	..	..	r		
Leprotintinnus pellucidus (Cl.) Jørg.	..	..	..	..	..	rr									
Ptychocylis urnula (Clap. et Lachm.) Brandt α *major* Jørg.	..	..	..	..	..	r									
P. u. v. *minor* Jørg.	..	..	..	..	..	..	r	..	..	r	..	r+	r+	..	r
P. u. v. *digitalis* Auriv.	..	..	..	..	..	..	..	..	r	..	..	rr			
Tintinnopsis nitida Brandt	..	..	..	..	r	..	r								
Cyttarocylis denticulata (Ehrb.) Fol.	r	r	..	r	r+	c	c	r	..	+	r	r	r	r	r+
C. d. v. *cylindrica* Jørg.	..	..	..	..	..	+	+								
C. d. v. *gigantea* (Brandt) Cl.	..	..	..	..	..	r									
C. d. v. *elongata* Jørg.	..	..	r	..	..	..	r								
C. d. v. *subrotundata* Jørg.	..	r	..	..	..	+c	+								
C. d. v. *subedentata* Jørg. n. var.	..	..	..	..	..	+c	c								
Dictyocysta templum Hck. v. *disticha* Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr

Year 1899. Month	March						April							
Locality	Røst I, outside R.	Tysfjord I, inside Skarberget		Tysfjord II, inside the Tysfjord church		Tysfjord I	Lille Molla	Følstad, Østnesfjord	Helle, Østnesfjord	Brettesnes II	Skroven		Hola, at Svolvær	Stene in Bo (Vesteraalen)
Date	24/3	28/3	28/3	29/3	29/3	29/3	1/4	4/4	4/4	4/4	4/4	4/4	4/4	10/4
Depth (meters)	0—120	0—100	0—700	0—100	0—400	300—200	0	0—3	0—3	0—3	0—3	0—150	0—3	0
Salinity (0/00)	34.42—34.60	33.58—34.54	33.58—35.11	33.65—34.54	33.65—35.11			33.32	33.28	33.65	33.72	33.72—34.92	33.72	33.63
Temperature (Cels.)	3.1—4.25	0.75—5.5	0.75—6.3	1.55—5.75	1.55—6.3			÷0.4	0.5	1.1	1.1	1.1—6.5	0.8	1.05
I. *Bacillariales.*														
(Diatomaceæ).														
Bacterosira fragilis (GRAN) GRAN	..	..	..	..	..	..	..	+	+c	+c	..	r	+	+
Rhizosolenia obtusa HENS.	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Biddulphia aurita (LYNGB.) BRÉB.	r	..	..	..	..	..	r	r	r	r	rr	r	r	r
Chætoceros borealis BAIL.	..	..	..	..	..	..	..	..	..	..	rr	r		
C. densus (CL.) CL.	r	r	r	r	r									
C. danicus CL.	..	..	..	..	..	..	..	..	r					
C. concolutus CASTR.	r	..	..	..	..	..	+	r	r	+c	+c	+c	c	
C. atlanticus CL.	r	..	..	..	..	..	r	..	..	rr				
C. decipiens CL.	r	..	r	..	..	..	r	r	..	r+	r	r+	+	
C. teres CL.	..	..	..	..	..	..	..	r	r	r+	..	..	..	r
C. laciniosus SCHÜTT	..	..	..	..	..	..	..	..	r+	..	r			
C. brevis SCHÜTT	..	..	..	..	..	..	..	..	r+					
C. Willei GRAN	..	..	..	..	..	..	..	..	..	..	..	..	..	r
C. diadema (EHRB.) GRAN	..	..	..	..	..	..	..	r+	c	+	r+	r	r	+
C. debilis CL.	..	..	..	..	..	..	..	+	..	r	..	..	..	+
C. socialis LAUD.	..	..	..	..	..	..	+	cc	cc	cc	cc	+	cc	cc
C. furcellatus BAIL.	..	..	..	..	..	..	r	+	..	..	..	..	..	c
Ditylium Brightwellii (WEST) GRUN.	r	..	r											
Sceletonema costatum (GREV.) CL.	r	..	..	..	..	..	r+	cc	c	+c	c	+	c	+
Thalassiosira Nordenskjöldii CL.	..	..	..	..	..	..	+c	+	c	c	+c	..	+c	cc
T. gravida CL.	..	..	..	..	..	..	..	r	..	r	..	..	r	+
T. hyalina (GRUN.) GRAN	..	..	..	..	..	..	..	c	+c	c	c	+c	c	c
T. gelatinosa HENS	..	..	..	..	..	..	r+	r+	r	r	..	+	+	
Porosira glacialis (GRUN.)	..	..	..	..	..	..	..	..	..	r	..	..	..	+r
Coscinosira polychorda (GRAN) GRAN	..	..	..	..	..	..	..	r	..	r	..	r	r	
Actinocyclus Ehrenbergii RALFS	+c	r	..	..	..	..	..	..	..	..	..	r		
Coscinodiscus excentricus EHRB.	r													
C. curvatulus GRUN.	..	..	..	..	..	..	..	..	..	..	..	r		
C. stellaris ROP.	r													
C. radiatus EHRB.	r	r	r											
C. subbulliens JØRG.	..	..	..	..	r	..	..	..	..	..	..	r	r	
C. oculus iridis EHRB.	..	..	..	..	..	..	r	..	..	..	..	..	r	
C. centralis EHRB.	c	r	+	..	r	..	r	..	..	r	..	+		
C. concinnus W. SM.	..	..	..	..	..	..	..	..	..	r	..	..	r	
Euodia gibba BAIL.	rr													
Hyalodiscus stelliger BAIL.	..	..	r											
Nitzschia seriata CL.	..	..	..	..	..	..	+c	+	+	+c	c	+c	c	+
N. lanceolata W. SM.	..	..	..	..	..	..	r	..	r	..	..	r	r	
N. delicatissima CL.	..	..	..	..	..	..	..	..	..	..	+c	r	r	
N. longissima (BRÉB.) RALFS.	..	..	..	..	..	..	..	r	rr					
Thalassiothrix Frauenfeldii GRUN.	..	..	..	r	..	..	..	..	..	+c	+	r	..	r

Year 1899. Month	March						April							
Locality	Røst I, outside R.	Tysfjord I, inside Skarberget		Tysfjord II, inside the Tysfjord church		Tysfjord I	Lille Molla	Følstad, Østnesfjord	Helle, Østnesfjord	Brettesnes II	Skroven		Hola, at Svolvær	Stene in Bø (Vesteraalen)
Date	24/3	28/3	28/3	29/3	29/3	29/3	1/4	4/4	4/4	4/4	4/4	4/4	4/4	10/4
Depth (meters)	0—120	0—100	0—700	0—100	0—400	300—200	0	0—3	0—3	0—3	0—3	0—150	0—3	0
Salinity (‰)	34.42—34.60	33.58—34.54	33.58—35.11	33.65—34.54	33.65—35.11			33.32	33.28	33.65	33.72	33.72—34.92	33.72	33.63
Temperature (Cels.)	3.1—4.25	0.75—5.5	0.75—6.3	1.55—5.75	1.55—6.3			÷0.4	0.5	1.1	1.1	1.1—6.5	0.8	1.05
Thalassiothrix Frauenfeldii v. nitzschioides (Grun.) Jørg.	r	..	..	..	..	..	+c	c	+	..	..	..	+	
Fragilaria oceanica Cl.	rr	..	..	..	..	..	c	c	cc	cc	cc	c	cc	c
F. cylindrus Grun.	..	..	..	..	..	..	cc	c	c	cc	cc	c	cc	c
Navicula septentrionalis Oestr.	..	..	..	..	..	..	..	..	..	r+	..	r	+	r
N. Vanhöffeni Gran	..	..	..	..	..	..	r+	r	+	r	r	+c	r	
N. pelagica Cl.	..	..	..	..	..	..	..	..	..	..	r	r	r	
N. directa W. Sm.	..	..	..	..	..	..	r+	..	+	..	..	r+	r	r
N. kariana Grun.	..	..	..	..	..	..	..	r	r	+c	r+	..	r	
Actinoptychus undulatus (Bail.?) Ralfs	..	..	r											
Auliscus sculptus (W. Sm.) Ralfs	..	..	..	..	..	..	..	..	..	..	..	r		
Campylodiscus angularis Greg.	..	..	..	..	rr									
Grammatophora oceanica Ehrb.	..	..	..	..	..	..	..	..	..	..	..	r		
Rhabdonema minutum Kütz.	..	..	..	..	..	..	r							
Nitzschia spathulata Bréb.	..	..	..	..	..	..	..	..	..	..	r			
N. bilobata W. Sm.	..	..	..	..	..	..	..	..	..	..	..	..	r	
N. Closterium W. Sm.	..	..	..	..	..	..	..	..	r					
Glyphodesmis Williamsonii (W. Sm.) Grun.	..	..	..	..	rr									
Cocconeis scutellum Ehrb.	..	..	..	..	..	..	r	r	r	..	..	..	r	
C. costata Greg.	..	..	..	..	..	..	r	..	..	..	..	..	r	
Pleurosigma Normanni Ralfs.	..	..	..	..	..	..	r							r
P. fasciola W. Sm.	..	..	..	..	..	..	..	..	..	..	..	..	..	
Schizonema Grevillei Ag.	..	..	..	..	..	..	r							
Pinnularia quadratarea A. Schm.	..	..	..	..	..	..	..	..	..	..	..	r		

II. Peridiniales.
(Dinoflagellata).

Dinophysis acuta Ehrb., Jørg.	rr	r	..	..	rr	..	..	r						
Diplopsalis lenticula Bergh	rr	r	r+											
Peridinium depressum Bail.	r+	+	c	r	+	..	r	..	..	r	..	r+		
P. oceanicum Vanhöf.	..	..	r											
P. divergens Ehrb. (*P. lenticulare* (Ehrb.) Jørg.)	r	+c	cc	+c	c	r+	r	..	..	..	..	rr		
P. pallidum Ostenf.	rr	r	r+	r										
P. Steinii Jørg.	..	..	rr											
P. ovatum (Pouch.) Schütt.	..	..	..	..	..	..	..	..	..	rr				
Ceratium tripos (O. F. Müll.) Nitzsch. (*α balticum* Schütt)	c	c	c	r	r	..	r	..	..	r	..	r+		
C. bucephalum (Cl.) Cl.	+c	r+	r+	..	+	..	..	..	..	..	..	r		
C. macroceros (Ehrb.) Cl.	c	r	r	..	r	..	..	..	..	..	..	rr		
C. intermedium (Jørg.)	r+	+	r	r	r									
C. longipes (Bail.) Cl.	+	c	c	c	c	r	r	r	..	r+	..	+		
C. furca (Ehrb.) Duj.	+	+	+	r	r	..	r	..	..	..	..	rr		
C. fusus (Ehrb.) Duj.	c	c	+c	+	+	..	..	..	..	rr	..	r		

Year 1899. Month	March						April							
Locality	Røst I, outside R.	Tysfjord I, inside Skarberget		Tysfjord II, inside the Tysfjord church		Tysfjord I	Lille Molla	Følstad, Østnesfjord	Helle, Østnesfjord	Brettesnes II	Skrover		Hola, at Svolvær	Stene in Bø (Vesteraalen)
Date	24/3	28/3	28/3	29/3	29/3	29/3	1/4	4/4	4/4	4/4	4/4	4/4	4/4	10/4
Depth (meters)	0—120	0—100	0—700	0—100	0—400	300—200	0	0—3	0—3	0—3	0—3	0—150	0—3	0
Salinity (‰)	34.42—34.60	33.58—34.54	33.58—35.11	33.65—34.54	33.65—35.11			33.32	33.28	33.65	33.72	33.72—34.92	33.72	33.63
Temperature (Cels.)	3.1—4.25	0.75—5.5	0.75—6.3	1.55—5.75	1.55—6.3			÷0.4	0.5	1.1	1.1	1.1—6.5	0.8	1.05
III. Pterospermataceæ.														
Pterosperma Möbii (JØRG.) OSTENF.	..	..	..	..	..	..	..	..	..	r				
P. Vanhöffeni (JØRG.) OSTENF.	r+	..	..	..	..	..	r	..	..	r				
P. dictyon (JØRG.) OSTENF.	+	r	r+	r	..	..	r	..	..	r	..	r		
IV. Halosphæraceæ.														
Halosphæra viridis SCHMITZ (incl. *H. minor* OSTENF.)	..	c	c	..	..	r	cc	..	..	+c	..	r+	..	r
V. Flagellata.														
Phæocystis Poucheti (HAR.) LAGERH.	..	..	..	..	..	..	..	..	cc	cc	cc	c	cc	cc
VI. Silicoflagellata.														
Distephanus speculum (EHRB.) STØHR	..	..	..	..	..	..	r	r	r	r	r	rr	r	r
Gymnaster pentasterias (EHRB.) SCHÜTT.	..	..	..	..	..	..	r							
VII. Radiolaria.														
1. Spumellaria.														
Hexacontium enthacanthum JØRG.	..	..	r+	..	r									
H. pachydermum JØRG.	..	..	r	..	r									
Echinomma trinacrium HCK.	..	..	r	..	..	..	..	..	..	..	..	r		
E. leptodermum JØRG.	..	..	+	..	..	..	..	..	..	..	..	r		
Drymyomma elegans JØRG.	..	..	r											
Chromyomma boreale (CL.) JØRG.	r	..	+	..	r+	r								
Rhizoplegma boreale (CL.) JØRG.	..	..	+	..	..	..	..	..	..	..	..	r		
Lithelius minor JØRG.	..	..	r											
Phorticium pylonium HCK.?, CL.	..	..	r	..	..	..	..	..	..	..	..	r		
Sorolarcus circumtextus JØRG.	..	..	r	..	..	..	..	..	..	..	..	r		
2. Nassellaria.														
Plagiacantha arachnoides CLAP. et LACHM.	..	..	..	..	r	..	..	..	..	r				
Campylacantha cladophora JØRG. n. sp.	..	..	r											
Plectacantha oikiskos JØRG. n. sp.	..	..	r	..	..	..	..	..	..	..	..	r		
Phormacantha hystrix (JØRG.) JØRG.	..	..	r											
Gonosphæra primordialis JØRG. n. sp.	..	..	r											
Peridium longispinum JØRG.	..	..	r	..	..	..	..	..	..	..	..	r		
Euscenium corynephorum JØRG.	..	..	r											
Cladoscenium tricolpium (HCK.?) JØRG.	..	..	r											

Year 1899. Month	March						April							
Locality	Rost I, outside R.	Tysfjord I, inside Skarberget		Tysfjord II, inside the Tysfjord church		Tysfjord I	Lille Molla	Følstad, Østnesfjord	Helle, Østnesfjord	Brettesnes II	Skroven		Hola, at Svolvær	Stene in Bo (Vesteraalen)
Date	24/3	28/3	28/3	29/3	29/3	29/3	1/4	4/4	4/4	4/4	4/4	4/4	4/4	10/4
Depth (meters)	0—120	0—100	0—700	0—100	0—400	300—200	0	0—3	0—3	0—3	0—3	0—150	0—3	0
Salinity (‰)	34.42—34.60	33.58—34.54	33.58—35.11	33.65—34.54	33.65—35.11			33.32	33.28	33.65	33.72	33.72—34.92	33.72	33.63
Temperature (Cels.)	3.1—4.25	0.75—5.5	0.75—6.3	1.55—5.75	1.55—6.3			÷0.4	0.5	1.1	1.1	1.1—6.5	0.8	1.05
Helotholus histricosa Jørg. n. sp.	..	..	r	..	..	r	..	..	..	..	..	r		
Litharachnium tentorium Hck.	..	..	..	..	..	..	..	..	..	..	..	r		
Dictyophimus Clevei Jørg.	..	..	r	..	..	..	..	..	..	..	..	r		
Lithomelissa setosa (Cl.) Jørg.	..	..	r	..	..	..	r	..	..	..	..	r		
L. hystrix Jørg.	..	..	r											
Dictyoceras acanthicum Jørg.	..	..	r											
D. xiphephorum Jørg.	..	..	..	..	..	..	..	..	..	..	..	r		
Clathrocyclas craspedota (Jørg.) Jørg.	..	..	r +	..	r									
Androcyclas gamphonycha (Jørg.) Jørg.	..	..	r +	..	..	..	..	..	..	..	..	r		
A. amblycephalis (Jørg.) Jørg.	..	..	..	..	r									
Stichocorys seriata (Jørg.) Jørg.	..	..	r											
3. Phæodaria (Tripylea).														
Cannosphæra lepta Jørg.	..	..	..	..	..	..	..	..	..	..	..	r		
Protocystis xiphodon (Hck.) Borg.	..	..	r											
P. Harstoni (Murray) Borg.	r	..	r											
P. tridens (Hck.) Borg.	..	..	..	..	..	..	..	..	..	..	..	r		
Challengeron diodon Hck. (*C. heteracanthum* Jørg.)	..	..	r											
VIII. Tintinnodea.														
Ptychocylis urnula (Clap. et Lachm.) Brandt	..	..	r	..	rr									
Cyttarocylis denticulata (Ehrb.) Fol.	..	..	r	r	+	..	r							
C. d. v. *elongata* Jørg.	..	..	r											
C. d. v. *subrotundata* Jørg.	..	..	..	..	r									
C. d. v. *subedentata* Jørg.	..	..	..	..	..	..	..	..	..	rr				
Undella caudata Ostenf.	..	..	r	..	rr									

Year 1899. Month	April													
Locality	Gaukværø II, Vesteraalen		Malangen, off Stønnesbotn		Stønnesbotn	Senjenhavet	Malangen		Kvænangen I, between Spildern and Kvænangstinderne	Jøkelfjord I. at the head		Jøkelfjord III. off the Tverfjord	Kvænangen, between Spildern and the northern mainland	
Date	11/4	11/4	12/4	12/4	13/4	13/4	14/4	14/4	19/4	20/4	20/4	20/4	21/4	21/4
Depth (meters)	0—3	0—250	0—100	0—380	0—3	0—80	0—3	380—300	0—50	0	0—100	0—90	0 100	200—300
Salinity ($^0/_{00}$)	34.17	34.17—34.86	33.96—34.35	33.96—34.67		34.60—34.97	34.17	(34.67)	34.21	34.21	34.21—34.29	34.29—34.35	34.35—34.36	34.60—34.49
Temperature (Cels.)	2.85	2.85—5.2	1.6—2.15	1.6—4.1		3.35—5.3	1.7	(4.1)	0.75	0.85	0.85—1.0	0.80—1.4	1.05—1.2	1.95—2.2
I. Bacillariales. *(Diatomaceæ).*														
Bacterosira fragilis (GRAN) GRAN	+	+c	+	+	r	r	+	+	c	+	r	c	..	c
Corethron hystrix HENS	..	..	..	..	..	rr								
Rhizosolenia alata BRIGHTW.	..	..	..	..	..	r								
R. Shrubsoli CL.	..	..	r											
R. setigera BRIGHTW.	..	..	..	..	..	..	..	r						
Biddulphia aurita (LYNGB.) BRÉB.	r	+	..	r	..	r	..	..	+c	+	r	+c	..	+c
Chætoceros borealis BAIL.	..	..	..	..	..	..	..	..	r	r	..	r	..	r
C. densus (CL.) CL.	..	..	..	..	..	..	..	..	r					
C. convolutus CASTR.	r+	+	r	r	..	+	..	r+	..	r	..	r	..	r
C. atlanticus CL.	..	..	..	..	..	r	..	+	r					
C. decipiens CL.	r+	+	..	r	..	r	rr	r	r+	+	..	+	..	r
C. teres CL.	r	..	..	r	..	..	..	..	r					
C. contortus SCHÜTT	..	..	r	r+	..	..	..	..	..	..	..	..	..	r
C. similis CL.	r	..	..	..	..	r								
C. laciniosus SCHÜTT	..	..	r	r	..	..	..	..	..	..	..	..	..	r
C. Willei GRAN	..	..	..	..	..	..	..	..	..	..	..	..	..	r
C. diadema (EHRB.) GRAN	..	r+	+c	+c	+c	r	+	+	+	r	..	..	..	+
C. debilis CL.	..	r	cc	c	c	r	c	..	..	..	..	..	..	r
C. socialis LAUD.	cc	cc	cc	cc	cc	..	cc	..	..	..	..	c	..	cc
C. furcellatus BAIL.	cc	cc	cc	c	c	c	cc	c	r	r	..	+	..	+c
Ditylium Brightwellii (WEST) GRUN.	..	..	..	..	..	r								
Sceletonema costatum (GREV.) CL.	+c	+	..	r+	r+	r	..	..	r	..	..	r	..	+
Thalassiosira Nordenskjöldii CL.	cc	+c	+	+c	c	c	c	c	+	..	..	r	+	+c
T. gravida CL.	+	+	+	+	c	+c	+	c	c	c	..	+	+	+c
T. hyalina (GRUN.) GRAN	c	cc	c	c	c	cc	+c	c	c	+	..	c	c	cc
T. gelatinosa HENS.	..	..	..	+	..	r	..	..	..	..	..	+c	..	+
Coscinosira polychorda (GRAN) GRAN	r	+	+c	..	+	+	+c	+	..	..	..	r	..	c
Porosira glacialis (GRUN.)	+	+c	cc	cc	c	+c	cc	cc	c	+	..	+c	c	c
Actinocyclus Ehrenbergii RALFS	..	..	..	r	..	r	..	r						
Coscinodiscus excentricus EHRB.	..	r	..	r	..	r								
C. curvatulus GRUN.	r													
C. radiatus EHRB.	..	r+	..	+	..	c	..	+c						
C. subbulliens JØRG. n. sp.	r	..	..	r										
C. centralis EHRB.	..	+	..	+	..	+	..	+	+	..	+	..	..	r
C. concinnus W. SM.	..	..	r	r+	..	..	..	r	c	..	..	+		
C. bioculatus GRUN.	..	..	r+	r+	+									
Hyalodiscus stelliger BAIL.	..	..	..	r	..	..	..	r						
Nitzschia seriata CL.	c	c	c	c	+c	+	+	+c	c	r	..	+	..	c
N. delicatissima CL.	..	r+	r+	+										
N. longissima (BRÉB.) RALFS	..	..	..	r										

Year 1899. Month	April													
Locality	Gaukværø II, Vesteraalen		Malangen, off Stønnesbotn		Stønnesbotn	Senjenhavet	Malangen		Kvænangen I, between Spildern and Kvænangstinderne	Jøkelfjord I, at the head		Jøkelfjord III, off the Tverfjord	Kvænangen, between Spildern and the northern mainland	
Date	11/4	11/4	12/4	12/4	13/4	13/4	14/4	14/4	19/4	20/4	20/4	20/4	21/4	21/4
Depth (meters)	0—3	0—250	0—100	0—380	0—3	0—80	0—3	380—300	0—50	0	0—100	0—90	0—100	200—300
Salinity (‰)	34.17	34.17—34.86	33.96—34.35	33.96—34.67		34.60—34.97	34.17	(34.67)	34.21	34.21	34.21—34.29	34.29—34.35	34.35—34.35	34.30—34.49
Temperature (Cels.)	2.85	2.85—5.2	1.6—2.15	1.6—4.1		3.35—5.3	1.7	(4.1)	0.75	0.85	0.85—1.0	0.80—1.4	1.05—1.3	1.95—2.2
Thalassiothrix Frauenfeldii Grun.	+	+	+	+	+	r+	r+	c	r	r	..	..	..	r
T. F. v. *nitzschioides* (Grun.) Jørg. *f. curvata* (Castr.) Jørg.	..	..	..	+	..	..	..	..	..	..	..	r		
Fragilaria oceanica Cl.	cc	cc	c	c	+c	cc	c	c	c	c	c	cc	cc	cc
F. cylindrus Grun.	cc	+	+	+c	+c	c	r	..	..	..	..	+	..	+
Achnanthes tæniata Grun.	..	..	..	r	..	r	..	..	r	..	..	..	..	r
Navicula septentrionalis (Oestr.) Cl.	+c	+c	+	r	r+	+c	r	+	r+	..	..	r		
N. Vanhöffeni Gran	r+	r	..	..	..	..	..	..	..	r	..	..	..	r+
N. pelagica Cl.	..	r	r	r	..	..	..	..	..	..	..	r	..	r
N. kariana Grun.	..	r	+	r+	r+	..	r	..	r	r	..	r		
N. directa W. Sm.	..	..	..	r										
Actinoptychus undulatus (Bail.?) Ralfs	..	..	..	..	..	..	..	r						
Nitzschia Closterium W. Sm.	..	..	r	..	r	..	..	..	..	..	..	..	..	r
Grammatophora oceanica Ehrb.	..	..	..	r										
Rhabdonema arcuatum (Lyngb.) Kütz.	r													
Pleurosigma fasciola W. Sm.	..	..	..	..	..	..	..	..	r	..	..	r	..	r

II. Peridiniales.
(Dinoflagellata).

Dinophysis acuta Ehrb., Jørg.	..	..	..	..	..	r								
Gonyaulax spinifera (Clap. et Lachm.) Dies.	..	..	..	..	..	r								
Peridinium depressum Bail.	r	..	..	..	..	..	..	..	rr					
P. divergens Ehrb. (*P. lenticulare* (Ehrb.) Jørg.)	..	..	..	..	..	..	..	..	..	..	r			
P. pallidum Ostenf.	..	r	r	..	..	r	..	r	r	..	r	..	..	r
P. globulus Stein	..	r												
P. ovatum (Pouch.) Schütt	..	..	..	..	..	r	..	r	r					
P. Steinii Jørg.	..	..	..	..	..	r								
Ceratium tripos (O. F. Müll.) Nitzsch. (α *balticum* Schütt)	..	r	..	..	..	r	..	r+	r	r	..	..	..	r
C. bucephalum (Cl.) Cl.	..	r	..	..	..	r	..	r+	r					
C. macroceros Ehrb. (Cl.)	..	r	..	..	..	r	..	r						
C. longipes (Bail.) Cl.	..	r	..	..	..	+	..	+	r	..	r			
C. furca (Ehrb.) Duj.	..	r	..	..	..	r	..	r+						
C. fusus (Ehrb.) Duj.	..	r	..	..	..	r	..	r	r	..	..	..	..	r

III. Pterospermataceæ.

Pterosperma Möbii (Jørg.) Ostenf.	..	..	..	..	..	..	..	..	..	r	r			
P. Vanhöffeni (Jørg.) Ostenf.	..	r	..	..	..	..	..	r	..	r				
P. dictyon (Jørg.) Ostenf.	..	..	..	..	..	..	..	r	..	r	+	r		

IV. Halosphæraceæ.

Halosphæra viridis Schmitz (incl. *H. minor* Ostenf.)	..	..	..	..	r	..	..	..	+	..	r	r		

Year 1899. Month	April													
Locality	Gaukværø II, Vesteraalen		Malangen, off Stonnesbotn		Stønnesbotn	Senjenhavet	Malangen		Kvænangen I, between Spildern and Kvænangstinderne	Jøkelfjord I, at the head		Jøkelfjord III, off the Tverfjord	Kvænangen, between Spildern and the northern mainland	
Date	11/4	11/4	12/4	12/4	13/4	18/4	14/4	14/4	19/4	20/4	20/4	20/4	21/4	21/4
Depth (meters)	0—3	0—250	0—100	0—380	0—3	0—80	0—3	380—300	0—50	0	0—100	0—90	0—100	200—300
Salinity (‰)	34.17	34.17—34.80	33.96—34.35	33.06—34.67		34.60—34.97	34.17	(34.67)	34.21	34.21	34.21—34.29	34.29—34.35	34.35—34.35	34.60—34.49
Temperature (Cels.)	2.85	2.85—5.2	1.6—2.15	1.6—4.1		3.35—5.3	1.7	(4.1)	0.75	0.85	0.85—1.0	0.85—1.4	1.05—1.2	1.95—2.2
V. *Flagellata.*														
Phæocystis Poucheti (HAR.) LAGERH.	cc	cc	cc	..	..	+	..	..	..	+c	..	+	..	+
VI. *Silicoflagellata.*														
Distephanus speculum (EHRB.) STØHR	r+	..	r+	r	r+	r	rr	..	..	..	..	..	r	r
Dictyocha fibula EHRB.	rr	..	..	r	..	..	..	r						
VII. *Radiolaria.*														
1. *Spumellaria.*														
Echinomma leptodermum JØRG.	..	..	..	..	..	..	..	r						
2. *Nassellaria.*														
Campylacantha cladophora JØRG. n. sp.	..	..	..	..	..	..	..	r						
Phormacantha hystrix (JØRG.) JØRG.	..	..	..	r										
Peridium longispinum JØRG.	..	..	..	r	..	..	..	r						
Lithomelissa setosa (CL.) JØRG.	..	..	..	..	..	..	..	r						
VIII. *Tintinnodea.*														
Tintinnus acuminatus CLAP. et LACHM.	..	..	..	..	..	rr	..	..	..	r	r			
Tintinnopsis nitida BRANDT	..	..	..	..	..	..	..	..	..	..	r	r		
Cyttarocylis denticulata (EHRB.) FOL. v. *subedentata* JØRG n. var.	..	r	..	..	..	r	..	r						

Year 1899. Month	April								May				
Locality	Hammerfest harbour	Troldfjord, at Rolfsø	Ingøhavet		Breisund	Repvaag harbour	Porsanger-fjord		Vardø	Lyngen I, off Skibotten	Lyngen II, off the Kaafjord	Lyngen III, between Gamvik and Ulø	Høla, Svolvær
Date	22/4	23/4	24/4	24/4	25/4	26/4	27/4	27/4	1/5	3/5	5/5	3/5	5/5
Depth (meters)	0—8	0—6	0—100	0—300	0—3	0—10	0—75	200—100	0—200	0—100	0—250	0—300	0—150
Salinity ($^0/_{00}$)			34.86—35.18	34.86—35.24	34.54		34.60—34.67	34.48—34.60	34.72—34.65	34.17—34.30	34.17—34.47	34.17—34.84	33.73—34.84
Temperature (Cels.)			3.2—3.8	3.2—3.45	1.7		1.05—1.0	0.20—0.95	2.0—2.25	1.7—2.3	1.1—2.85	1.35—3.6	2.65—6.15
I. Bacillariales. *(Diatomaceæ).*													
Bacterosira fragilis (GRAN) GRAN	+	c	r+	r	c	r+	..	r	r	r	+c	+	
Rhizosolenia alata BRIGHTW.	..	..	..	r	..	..	..	..	r+				
R. obtusa HENS.	..	..	..	..	..	..	r	r					
R. semispina HENS.	..	..	..	r	..	..	..	..	r				
Biddulphia aurita (LYNGB.) BRÉB.	r	r	..	r+	r	r	r	+	+	cc	cc	c	
Eucampia groenlandica CL.	..	..	..	r									
Chætoceros borealis BAIL.	..	..	..	..	..	..	..	..	..	..	..	rr	r
C. criophilus CASTR.	..	..	..	r									
C. convolutus CASTR.	..	..	r	r	..	..	r	r	+	+	r	r	r+
C. atlanticus CL.	..	r	r	r	..	r	..	r	r+	..	..	rr	
C. decipiens CL.	+	r	r	r	r	r	r	..	r+	+	+	+	
C. teres CL.	r	r	r	r	r	r	..	r	r	..	r	r+	
C. contortus SCHÜTT	+	r	+c	+c	r	r+	+	+	+c	..	..	+	
C. constrictus GRAN	..	..	..	r	..	..	..	..	r				
C. laciniosus SCHÜTT	r	r	r	r	+c	+	r+	+					
C. diadema (EHRB.) GRAN	c	+	r+	r+	c	+c	+	+c	c	+c	+	c	
C. scolopendra CL.	..	..	..	rr	..	..	r						
C. debilis CL.	r	+	+	+	+	+c	c	+c	+	+	c		
C. socialis LAUD.	ccc	c	cc	cc	ccc	cc	c	c	c	cc	c	c	
C. furcellatus BAIL.	cc	+c	c	c	cc	c	c	c	c	cc	c	cc	
Ditylium Brightwellii (WEST.) GRUN.	..	..	..	rr									
Sceletonema costatum (GREV.) CL.	+c	+c	+c	+c	+	+c	c	+c	c	r	r	r	
Thalassiosira Nordenskjöldii CL.	c	cc	c	cc	c	c	c	c	cc	r	+c	cc	
T. gravida CL.	c	c	c	c	c	c	c	c	c	cc	cc	c	
T. hyalina (GRUN.) GRAN	c	c	c	c	c	+c	cc	cc	cc	+c	+	+	r
T. gelatinosa HENS.	r	r+	+	+	+	r	+	+	c	r	..	r	r
Coscinosira polychorda (GRAN) GRAN	+	+	+c	+c	c	+	+c	+c	c	c	+c	r	
Porosira glacialis (GRUN.)	c	c	+c	c	c	c	+	+	+	cc	cc	c	
Actinocyclus Ehrenbergii RALFS.	..	..	..	r									
Coscinodiscus radiatus EHRB.	..	..	..	r	..	..	..	..	..	..	..	..	+
C. centralis EHRB.	..	..	..	..	..	..	..	..	r				
C. concinnus W. SM.	..	r	r	r	..	..	..	r	..	r	r		
C. bioculatus GRUN.	..	..	r	..	r	..	..	..	..	+			
Nitzschia seriata CL.	+	+c	+	+	c	+	+c	+c	+	c	c	c	
N. delicatissima CL.	..	..	c	c	r	+c	+	+	c				
N. frigida GRUN.	r	..	..	..	..	..	r						
N. longissima (BRÉB.) RALFS.	..	..	r	..	..	..	r	r	r	..	..	r	
Thalassiothrix longissima CL. et GRUN.	..	..	..	..	..	rr	..	..	r				
T. Frauenfeldii GRUN.	+	+	+	+	+	+c	+	+	c	+	+c	+	
Fragilaria oceanica CL.	cc	cc	cc	cc	cc	c	c	c	cc	c	c	c	r
F. cylindrus GRUN.	r	r	..	c	c	r+	r	r	..	r	r	r	

Year 1899. Month	April								May				
Locality	Hammerfest harbour	Troldfjord, at Rolfsø	Ingøhavet		Breisund	Repvaag harbour	Porsanger-fjord		Vardø	Lyngen I, off Skibotten	Lyngen II, off the Kaafiord	Lyngen III, between Gamvik and Ulø	Høla, Svolvær
Date	22/4	23/4	24/4	24/4	25/4	26/4	27/4	27/4	1/5	3/5	3/5	3/5	5/5
Depth (meters)	0—8	0—6	0—100	0—300	0—3	0—10	0—75	200—100	0—200	0—100	0—250	0—300	0—150
Salinity ($^0/_{00}$)			34.86—35.18	34.86—35.24	34.54		34.60—34.67	34.48—34.60	34.72—34.65	34.17—34.30	34.17—34.47	34.17—34.84	33.73—34.84
Temperature (Cels.)			3.2—3.8	3.2—3.45	1.7		1.05—1.0	0.20—0.05	2.0—2.25	1.7—2.3	1.1—2.86	1.35—3.6	2.65—6.15
Achnanthes tæniata Grun.	r	r	..	..	..	r							
Pleurosigma tenerum Jørg. n. sp.	r	r	..	..	..	r	..	r	r	r	..	r	
Navicula septentrionalis Oestr.	r+	+	r	r+	+	r	..	..	..	r			
N. Vanhöffeni Gran	..	..	..	..	..	..	+	+	+	..	..	..	r
N. pelagica Cl.	..	..	..	..	r								
N. kariana Grun.	r	+	r	+	+	+	r+	+	r	..	..	+	
Actinoptychus undulatus (Bail.?) Ralfs	..	..	..	r									
Pleurosigma fasciola W. Sm. (incl. *P. tenuirostris* Grun.)	r	r	r	..	r	r	r						
Rhoicosigma arcticum Cl.	..	r											
II. Peridiniales. *(Dinoflagellata).*													
Dinophysis acuta Ehrb., Jørg.	..	..	..	..	..	rr							
D. norvegica Clap. et Lachm., Jørg.	..	..	..	..	..	..	..	..	..	..	..	..	r
D. rotundata Clap. et Lachm.	..	..	..	..	..	..	..	..	..	..	..	..	r
Peridinium depressum Bail.	..	..	..	..	..	..	..	..	r	..	..	..	r
P. divergens Ehrb. (*P. lenticulare* (Ehrb.) Jørg.)	..	..	..	..	..	..	..	..	..	..	..	..	r
P. pallidum Ostenf.	..	r	..	..	..	..	..	r	r+	..	..	..	r+
P. ovatum (Pouch.) Schütt	..	..	..	rr	..	..	..	..	r	..	r	..	r
P. Steinii Jørg.	..	..	..	r	..	r	..	..	r				
Ceratium bucephalum (Cl.) Cl.	..	..	..	..	..	..	..	..	rr				
C. tripos (O. F. Müll.) Nitzsch. (α *balticum* Schütt.)	..	..	r										
C. macroceros (Ehrb.) Cl.	..	..	..	r	..	..	..	..	..	..	..	rr	
C. longipes (Bail.) Cl.	..	..	..	..	..	..	..	..	..	..	..	..	+
C. furca (Ehrb.) Duj.	..	..	..	..	..	..	..	..	..	..	..	..	r+
C. fusus (Ehrb.) Duj.	rr	..	r	..	..	..	..	..	rr	..	..	..	r
III. Pterospermataceæ.													
Pterosperma Vanhöffeni (Jørg.) Ostenf.	..	..	..	rr									
P. dictyon (Jørg.) Ostenf.	..	..	..	..	..	..	..	..	..	rr			
IV. Halosphæraceæ.													
Halosphæra viridis Schmitz (incl. *H. minor* Ostenf.)	..	..	..	..	..	..	..	..	+	..	..	..	r
V. Flagellata.													
Phæocystis Poucheti (Har.) Lagerh.	r	..	c	c	c	ccc	c	..	..	+			

Year 1899. Month	April								May				
Locality	Hammerfest harbour	Troldfjord, at Rolsø	Ingøhavet		Breisund	Repvaag harbour	Porsangerfjord		Vardø	Lyngen I, off Skibotten	Lyngen II, off the Kaafjord	Lyngen III, between Gamvik and Ule	Hola, Svolvær
Date	22/4	23/4	24/4	24/4	25/4	26/4	27/4	27/4	1/5	3/5	3/5	3/5	5/5
Depth (meters)	0—8	0—6	0—100	0—300	0—3	0—10	0—75	200—100	0—200	0—100	0—250	0—300	0—150
Salinity (‰)			34.86—35.18	34.86—35.24	34.54		34.60—34.67	34.48—34.60	34.72—34.66	34.17—34.30	34.17—34.47	34.17—34.84	33.78—34.84
Temperature (Cels.)			3.2—3.8	3.2—3.45	1.7		1.05—1.0	0.20—0.95	2.0—2.25	1.7—2.3	1.1—2.85	1.35—3.6	2.65—6.15
VI. Silicoflagellata.													
Distephanus speculum (EHRB.) STØHR	r	r	r	r	..	r	r	..	r+	r	..	..	r
D. s. v. *octonaria* JØRG.	..	..	..	..	..	r							
VII. Tintinnodea.													
Ptychocylis urnula (CLAP. et LACHM.) BRANDT v. *minor* JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r
P. u. v. *digitalis* AURIV.	..	..	..	..	..	..	..	..	..	..	..	..	r
Tintinnopsis nitida BRANDT	..	r	..	..	..	..	..	r					
Cyttarocylis norvegica (DAD.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	+
C. denticulata (EHRB.) FOL.	..	..	..	..	..	..	..	..	..	..	..	..	r

Year 1900. Month	March														April
Locality	Høla, Svolvær		Skroven, 1 mile SSE		Henningsvær, $2^3/_4$ miles off	Balstad I		Reine	Tranødybet	Østnesfjord I, at the head	Østnesfjord III, off Helle	Balstad	Reine	Vestfjord	Skjerstadfjord II
Date	20/3	20/3	20/3	20/3	20/3	21/3	21/3	21/3	22/3	23/3	21/3	26/3	27/3	30/3	2/4
Depth (meters)	0—50	0—140	0—50	0—400	0—200	0—50	0—200	0—110	0—600	0—25	0—130	0—130	0—150	0—25	0—180
Salinity $(^0/_{00})$	34.02—34.14	34.02—34.65	34.14—34.21	34.14—35.15	34.14—34.91	34.11—34.21	34.11—35.18	34.09—34.21	34.09—35.10	33.92—33.96	33.92—?	34.09—34.52	34.16—34.83		33.73—33.99
Temperature (Cels.)	2.85—2.95	2.85—5.4	2.75—2.85	2.75—6.35	2.85—6.6	3.05—2.9	3.05—6.6	2.05—4.2	2.7—6.3	2.1—2.36	2.35—4.4	2.8—4	2.55—6.3		2.5—3.35
I. Bacillariales. *(Diatomaceæ).*															
Bacterosira fragilis (GRAN) GRAN	..	..	..	..	..	..	..	..	..	..	..	..	..	r	
Corethron hystrix HENS.	rr	..	..	..	r	..	..	..	..	..	..	r			
Rhizosolenia alata BRIGHTW.	..	..	..	..	..	..	..	..	..	..	..	..	..	rr	
R. Shrubsolii CL.	..	..	..	..	..	r									
Biddulphia aurita (LYNGB.) BRÉB.	r	r	..	r	..	..	r	..	..	c	r+	..	..	+c	r
Chætoceros borealis BAIL.	r+	r	..	..	..	r+	r	..	..	..	..	..	r		
C. densus CL.	r	r	..	..	..	..	..	..	..	..	r				
C. densus v. *rudis* CL.	r														
C. danicus CL.	r														
C. convolutus CASTR.	+	+	+	+c	+c	c	+c	c	r	r	c	c	c	r	r+
C. atlanticus CL.	r	r+	r	r	r	r+	r+	r+	..	..	r	..	r+		
C. decipiens CL.	+c	+c	r+	c	+	+	+c	+c	c	+	c	+c	+c	.	r
C. contortus SCHÜTT	r	..	..	..	..	..	..	..	..	..	r				
C. similis CL.	rr														
C. laciniosus SCHÜTT	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+
C. Willei GRAN	..	r													
C. diadema (EHRB.) GRAN	r	+	..	..	r	..	..	..	..	+	+	..	..	r	c
C. curvisetus CL.	..	..	..	..	..	r									
C. debilis CL.	..	r	..	r											
C. socialis LAUD.	+	+	..	..	..	..	..	..	..	cc	cc	..	..	cc	cc
C. furcellatus BAIL.	r	r+	..	..	..	..	..	..	..	c	+	..	..	c	
Ditylium Brightwellii (WEST) GRUN.	r	..	..	..	..	rr	rr	r	..	..	..	..	r		
Sceletonema costatum (GREV.) CL.	r	r	..	..	..	..	r	..	..	c	c	..	+	+	
Thalassiosira Nordenskjöldii CL.	..	..	..	..	..	..	..	..	..	c	r+	..	..	ccc	
T. gravida CL.	rr	r+	..	..	..	..	..	..	..	c	c	..	..	c	
T. hyalina (GRUN.) GRAN	..	..	..	..	..	..	..	..	..	cc	cc	..	..	cc	+
T. gelatinosa HENS	..	..	..	..	..	..	..	..	..	r	r	..	..	c	
Coscinosira polychorda (GRAN) GRAN	..	r	..	..	..	..	..	..	..	c	r				
Porosira glacialis (GRUN.)	+	c													
Actinocyclus Ehrenbergi RALFS	r	r	..	r	..	+	+	+	r+	..	r	r+	r+	..	+
Coscinodiscus excentricus EHRB.	..	..	..	..	r+	r	+	..	..	r	..	r	r		
C. stellaris ROP.	..	rr													
C. radiatus EHRB.	+c	r+	r	r	+	+c	r+	+	+	..	r	+	+		
C. subbulliens JØRG. n. sp.	..	..	..	..	r	..	..	..	r						
C. centralis EHRB.	r	r	..	r	+	r+	r	r+	r+	..	r	r+	+	..	+
C. concinnus W. SM.	..	..	..	..	..	..	..	..	..	r					
C. bioculatus GRUN.	..	..	..	..	..	..	..	..	..	..	+				
Eüodia gibba BAIL.	..	r													
Hyalodiscus stelliger BAIL.	..	r	..	..	r	..	r	..	r	..	..	r			
Nitzschia seriata CL.	..	..	..	..	..	..	..	..	..	c	+c	..	..	c	r
N. delicatissima CL.	..	r													

Year 1900. Month	March														April
Locality	Hola, Svolvær		Skroven, 1 mile SSE		Henningsvær, 2¾ miles off	Balstad I		Reine	Tranødybet	Østnesfjord I, at the head	Østnesfjord III, off Helle	Balstad	Reine	Vestfjord	Skjerstadfjord II
Date	20/3	20/3	20/3	20/3	20/3	21/3	21/3	21/3	23/3	24/3	25/3	26/3	27/3	30/3	2/4
Depth (meters)	0—50	0—140	0—50	0—400	0—200	0—50	0—200	0—110	0—600	0—25	0—180	0—130	0—150	0—25	0—180
Salinity (‰)	34.02—34.14	34.02—34.65	34.14—34.21	34.14—35.15	34.14—34.91	34.11—34.21	34.11—35.18	34.09—34.21	34.09—35.10	33.92—33.95	33.92—?	34.09—34.52	34.16—34.83		33.73—33.99
Temperature (Cels.)	2.85—2.95	2.85—5.4	2.75—2.85	2.75—6.35	2.85—6.6	3.05—2.9	3.05—6.6	2.95—4.2	2.7—6.3	2.1—2.35	2.35—4.4	2.8—4	2.55—6.3		2.5—3.35
Nitzschia recta Hantzsch.	..	..	..	..	..	..	..	..	..	r+					
N. hybrida Grun.	..	..	..	..	..	..	..	..	..	..	..	..	..	r	
N. frigida Grun.	..	..	..	..	..	..	..	..	..	r	..	..	..	r	
N. longissima (Bréb.) Ralfs.	..	..	..	..	..	..	..	..	..	..	..	..	..	r+	
Thalassiothrix nitzschioides Grun.	+c	c	..	r	..	r	r	r	r	c	cc	+c	c	..	c
Fragilaria oceanica Cl.	r+	+	..	r	..	..	..	..	..	cc	cc	..	..	cc	c
F. cylindrus Grun.	r+	..	..	..	..	..	..	..	..	cc	cc	+c	..	c	c
Achnanthes tæniata Grun.	..	r	..	..	..	..	..	..	..	..	r+				
Pleurosigma Stuxbergi Cl.	r	r	..	r+	..	r	..	+	r	..	c	..	r	+	
P. fasciola W. Sm. (incl. *P. tenuirostris* Grun.)	..	..	..	..	..	..	..	..	..	..	..	..	..	r	
Navicula Vanhöffeni Gran	r	..	..	..	..	..	..	..	..	c	r+	..	..	r	r
N. directa W. Sm.	..	..	..	..	..	..	..	..	..	+c	r				
N. kariana Grun.	r	..	..	..	..	..	..	..	..	+c	r	..	..	c	
Amphiprora (Tropidoneis) parallela Jørg. n. sp.	..	r	..	..	..	..	..	..	..	r	r	..	..	r	
Actinoptychus undulatus (Bail.?) Ralfs	..	rr	..	r											
Auliscus sculptus (W. Sm.) Ralfs	..	rr													
Campylodiscus Thuretii Bréb.	..	rr	..	r	..	..	r	..	r+	..	..	..	..	..	r
C. angularis Greg.	..	r	..	r											
Surirella lata W. Sm.	..	..	..	..	r										
Glyphodesmis Williamsoni (W. Sm.) Grun.	..	..	..	..	..	..	..	..	..	..	..	..	rr		
Rhabdonema arcuatum (Lyngb.) Kütz.	..	..	..	..	..	..	r	..	..	r					
Cocconeis scutellum Ehrb.	..	..	..	..	..	..	..	..	..	r					
Rhoicosigma arcticum Cl.	..	..	..	..	..	..	..	..	..	..	..	..	..	r	

II. Peridiniales.

(Dinoflagellata).

Dinophysis acuta Ehrb., Jørg.	r+	r	r	r	r	r	r	r	r	..	..	r	r		
D. norvegica Clap. et Lachm., Jørg.	r	r	..	r	r	r	r	r	rr	..	..	..	r		
D. rotundata Clap. et Lachm.	..	..	..	..	rr	..	..	r	r						
Podolampas palmipes Stein	..	..	..	..	..	..	..	..	rr						
Protoceratium reticulatum (Clap. et Lachm.) Bütschli.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr
Gonyaulax spinifera (Clap. et Lachm.) Dies.	r+	..	..	..	..	r									
Diplopsalis lenticula Bergh	r	r	r	..	..	r	r								
Peridinium depressum Bail.	r+	+c	r+	c	c	+	+c	+c	+	..	+	+	c	..	r
P. divergens Ehrb. (*P. lenticulare* (Ehrb.) Jørg.)	r	r+	r	r+	r	r	c	+	+	..	+c	..	+c		
P. conicum (Gran) Ostenf. et Schm.	r	r	..	r	..	..	r	..	..	..	..	..	..	..	r
P. pallidum Ostenf.	r	r	r	r+	r+	r+	+	+	r+	..	..	r	..	..	r
P. Steinii Jørg.	..	r	..	..	..	..	..	rr	r						
P. ovatum (Pouch.) Schütt.	+	r+	r+	+	+	r+	r+	r	r	..	r	r+	+	rr	+
Ceratium tripos (O. F. Müll.) Nitzsch. (*α balticum* Schütt)	r	+	+c	+	c	c	c	c	+	r	+c	c	+c	..	r
C. bucephalum (Cl.) Cl.	r+	r	+	+	c	c	c	c	r	..	..	c	c	rr	
C. b. v. *heterocampta* Jørg.	r	..	r	..	..	+	+	r+	..	..	..	r	+		

Year 1900. Month	March														April
Locality	Hela, Svolvær		Skroven, 1 mile SSE		Henningsvær, 2¾ miles off	Balstad I		Reine	Tranødybet	Østnesfjord I, at the head	Østnesfjord III, off Helle	Balstad	Reine	Vestfjord	Skjerstad-fjord II
Date	20/3	20/3	20/3	20/3	20/3	21/3	21/3	21/3	22/3	23/3	23/3	26/3	27/3	30/3	2/4
Depth (meters)	0—50	0—140	0—50	0—400	0—200	0—50	0—200	0—110	0—600	0—25	0—130	0—130	0—150	0—25	0—180
Salinity (‰)	34.02—34.14	34.02—34.65	34.14—34.21	34.14—35.15	34.14—34.91	34.11—34.21	34.11—35.18	34.09—34.21	34.09—35.10	33.92—33.95	33.92—?	34.09—34.52	34.16—34.83		33.73—33.99
Temperature (Cels.)	2.85—2.95	2.85—5.4	2.75—2.85	2.75—6.35	2.85—6.6	3.05—2.9	3.05—6.6	2.95—4.2	2.7—6.3	2.1—2.35	2.35—4.4	2.8—4	2.55—6.3		2.5 3.35
Ceratium macroceros (EHRB.) CL.	r+	+c	c	c	c	c	c	c	+c	rr	r	c	c	..	r
C. intermedium (JØRG.)	r	r	r	r	..	r	+c	r	r	..	..	r			
C. longipes (BAIL.) CL.	c	c	c	c	cc	c	cc	+c	cc	..	c	c	c	rr	r
C. furca (EHRB.) DUJ.	+	+c	r	..	+	+	+	+	r	..	r	+	+c		
C. lineatum (EHRB.) CL.	..	..	..	..	..	..	r	..	..	..	..	r	..	rr	
C. fusus (EHRB.) DUJ.	+c	c	c	+c	c	c	c	c	c	..	c	c	c	..	r
III. Pterospermataceæ.															
Pterosperma Möbii (JØRG.) OSTENF.	r	r	..	r	r	+	r	r+	r	..	..	r	..	..	r
P. Vanhöffeni (JØRG.) OSTENF.	+	+	..	..	r	c+	c	+	r	..	..	+c	+c		
P. dictyon (JØRG.) OSTENF.	r	r	r	r+	+	+	+	+	+	..	r	r+	r	..	r
IV. Halosphæraceæ.															
Halosphæra viridis SCHMITZ (incl. *H. minor* OSTENF.)	+	+	c	+c	+	c	+	+c	r+	..	..	+c	+		
V. Flagellata.															
Phæocystis Poucheti (HAR.) LAGERH.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+c
VI. Silicoflagellata.															
Distephanus speculum (EHRB.) STØHR	r	r	..	..	..	..	..	..	..	r	+c	..	..	rr	
Dictyocha fibula EHRB.	r	r	..	r	..	r	r	r	r	..	..	r			
VII. Radiolaria.															
1. Spumellaria.															
Hexacontium enthacanthum JØRG.	..	..	..	..	..	..	..	..	r						
H. pachydermum JØRG.	..	r	..	r	..	..	..	..	r						
Echinomma leptodermum JØRG.	..	..	..	..	..	..	..	..	r	..	..	..	.	..	r
Chromyomma boreale (CL.) JØRG.	..	..	..	r	..	..	..	..	r						
Rhizoplegma boreale (CL.) JØRG.	..	r	rr	r	r	..	r	..	r	..	..	..	..	..	r
Lithelius minor JØRG.	..	..	..	r	..	..	r	..	r						
Phorticium pylonium HCK.?, CL.	..	..	..	..	..	..	r	..	..	..	..	..	..	..	r
2. Acantharia.															
Radiosphæra anacanthica JØRG. n. sp.	..	..	..	..	..	..	r								

Year 1900. Month	March														April
Locality	Hela, Svolvær		Skroven, 1 mile SSE		Henningsvær, $2^3/_4$ miles off	Balstad I		Reine	Tranødybet	Østnesfjord I, at the head	Østnesfjord III, off Helle	Balstad	Reine	Vestfjord	Skjerstadfjord II
Date	20/3	20/3	20/3	20/3	20/3	21/3	21/3	21/3	22/3	23/3	23/3	26/3	27/3	30/3	2/4
Depth (meters)	0—50	0—140	0—50	0—400	0—200	0—50	0—200	0—110	0—600	0—25	0—130	0—130	0—150	0—25	0—180
Salinity (‰)	34.02—34.14	34.02—34.65	34.14—34.21	34.14—35.15	34.14—34.91	34.11—34.21	34.11—35.18	34.09—34.21	34.09—35.10	33.92—33.95	33.92—?	34.09—34.52	34.16—34.83		33.73—33.99
Temperature (Cels.)	2.85—2.95	2.85—5.4	2.75—2.85	2.75—6.35	2.85—6.6	3.05—2.9	3.05—6.6	2.95—4.2	2.7—6.3	2.1—2.35	2.35—4.4	2.8—4	2.55—6.3		2.5—3.85
3. Nassellaria.															
Plagiacantha arachnoides CLAP. et LACHM.	r	r	..	r	..	..	..	..	r						
Campylacanth cladophora JØRG. n. sp.	..	..	..	..	..	..	r								
Plectacantha oikiskos JØRG. n. sp.	r	r	..	..	..	..	r	..	..	..	..	..	..	..	r
Phormacantha hystrix (JØRG.) JØRG.	..	r	..	..	..	..	r	..	r	..	..	..	..	..	r
Gonosphæra primordialis JØRG. n. sp.	..	r	..	r	..	..	r	..	r						
Peridium longispinum JØRG.	r	r	..	r	..	..	r	r							
Cladoscenium tricolpium (HCK.?) JØRG.	..	..	..	r	..	..	r								
Lithomelissa setosa (CL.) JØRG.	r	r	..	r	r	r	r	r	..	..	..	..	r	..	r
Dictyoceras acanthicum JØRG.	..	..	..	..	r										
Clathrocyclas craspedota (JØRG.) JØRG.	..	r	..	r	r	..	r								
Androcyclas gamphonycha (JØRG.) JØRG.	..	..	..	+	..	..	r	..	+						
A. amblycephalis (JØRG.) JØRG.	..	r+	..	r	r	.	r	..	+						
Stichocorys seriata (JØRG.) JØRG.	..	rr	..	r	..	..	r								
4. Phæodaria (Tripylea).															
Cannosphæra lepta JØRG.	..	r	..	r+	+	r	+	r	r+	..	..	r	r+		
Protocystis xiphodon (HCK.) BORG.	..	..	..	r											
P. Harstoni (MURRAY) BORG.	..	..	..	r											
P. tridens (HCK.) BORG.	r	r	..	r	r	..	r	r	r	..	..	..	r		
Challengeron diodon HCK. (*C. heteracanthum* JØRG.)	..	..	..	r	r	..	r								
Medusetta arcifera JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r		
VIII. Tintinnodea.															
Tintinnus acuminatus CLAP. et LACHM.	..	..	r	..	..	..	..	r	..	..	..	r	r		
Ptychocylis urnula (CLAP. et LACHM.) BRANDT v. *minor* JØRG.	..	r	..	..	r	r	..	r							
Tintinnopsis nitida BRANDT	r+	r	..	..	r	r	r	r	..	..	..	..	r	rr	r
T. campanula (EHRB.) DAD.	..	..	..	..	..	..	..	..	rr	..	..	..	..	..	r
Codonella lagenula (CLAP. et LACHM.) ENTZ. v. *ovata* JØRG.	..	..	..	..	..	..	..	..	rr						
C. ventricosa (CLAP. et LACHM.) FOL.	..	..	..	..	..	..	..	..	rr						
Cyttarocylis denticulata (EHRB.) FOL.	r+	..	+c	c	c	+c	c	c	+c	..	+c	r	..	..	r
C. d. α typica JØRG.	..	c	..	..	..	..	..	..	..	..	..	..	+c		
C. d. v. elongata JØRG.	..	r													
C. d. v. subedentata JØRG. n. var.	..	r	..	..	..	..	..	r							
C. serrata (MÖB.) BRANDT	..	..	..	..	..	..	..	..	rr						
Dictyocysta templum HCK. v. *disticha* JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r		
Undella caudata (OSTENF.) CL.	..	..	..	..	..	..	r	rr	rr	..	..	r			

Year 1900. Month	April														
Locality	Skjerstadfjord IV	Skjerstadfjord V	Skjerstadfjord VII	Skjerstadfjord XII		Midværfjord	Seivaagen, Saltenfjord	Saltenfjord II		Foldenfjord	Foldenfjord I			Vestfjord, between Flade and Skroven	
Date	2/4	2/4	2/4	4/4	4/4	5/4	5/4	5/4	5/4	6/4	6/4	6/4	6/4	7/4	7/4
Depth (meters)	0—330	0—420	0—480	0—50	0—500	0—25	0—20	0—50	0—330	0—580	0—100	300—200	500—400	0—50	0—315
Salinity ($^0/_{00}$)	34.04	33.85—34.04	—33.99	33.73—33.85	33.73—34.09			34.11	34.11—35.13		34.11—34.39	34.94—34.88	35.00—35.12	34.07—34.19	34.07—35.12
Temperature (Cels.)	3.2—3.15	2.4—3.15	—3.15	2.8—3.45	2.3—3.05			3.2—3.1	3.2—6.65		3.2—4.15	6.6	6.55	2.85—3.6	2.85—6.5
I. *Bacillariales.*															
(Diatomaceæ).															
Bacterosira fragilis (GRAN) GRAN	..	..	..	r	r	..	r	r							
Rhizosolenia alata BRIGHTW.	..	..	..	..	..	..	..	r	..	..	r				
Biddulphia aurita (LYNGB.) BRÉB.	r	r+	..	+	+c	+	r	+c	+c	r	r+	..	r	r	
B. mobiliensis BAIL.	..	..	..	..	..	..	..	..	..	..	..	..	r		
Chætoceros borealis BAIL.	..	..	..	..	r	..	..	..	..	..	r	..	..	r	r
C. densus CL. v. *rudis* CL.	..	r	..	..	..	..	..	..	..	..	..	..	..	r	
C. danicus CL.	..	..	..	..	..	..	..	rr	rr						
C. convolutus CASTR.	r	+	..	+c	r	r	r	r	r	+	c	+	r	c	c
C. atlanticus CL.	..	..	r	..	..	..	..	..	r	+c	..	..	r		
C. decipiens CL.	r+	+	+	+c	r	+	..	r	r+	+	+c	r	r	c	c
C. teres CL.	..	..	..	r	..	..	r	r	r+	r	..	..	..	r	r
C. contortus SCHÜTT	r	..	r	..	r	..	..	..	..	..	r				
C. laciniosus SCHÜTT	..	r	..	..	r	..	..	r+	..	..	r				
C. brevis SCHÜTT	..	..	..	..	..	..	..	..	..	..	r				
C. Willei GRAN	..	..	..	..	..	..	..	..	..	..	..	..	..	r	
C. diadema (EHRB.) GRAN	+c	c	+c	c	+c	+	+	+c	r	..	+c	..	..	+	+c
C. debilis CL.	..	..	..	+	+	+	+	r+	+c	+	c	+	..	+	
C. socialis LAUD.	cc	cc	c	ccc	cc	cc	cc	cc	cc	+	cc	+	r+	c	
C. furcellatus BAIL.	..	+	..	c	+	+c	c	..	..	..	+	..	r	+	+
Ditylium Brightwellii (WEST) GRUN.	..	r	..	..	..	..	..	r	r						
Sceletonema costatum (GREV.) CL.	..	..	r	..	r	..	+	+c	c	..	+c	..	r	+c	+
Thalassiosira Nordenskjöldii CL.	..	..	..	r	r	r	c	cc	cc	r	cc	c	+	+	
T. gravida CL.	..	r	..	+	+	..	+	+c	c	..	+c	r	r	c	
T. hyalina (GRUN.) GRAN	r	+	r+	..	r	..	r	c	+c	..	+	..	..	+c	+
T. gelatinosa HENS.	r	r+	..	+c	+	..	c	r	+c	r	+	..	..	r	
Coscinosira polychorda (GRAN) GRAN	r	..	r	c	c	+	+	+	+c	..	+c	..	..	r	
Porosira glacialis (GRUN.)	r	..	r	+	r	..	r	+c	c	r	+	+	..	r	r
Actinocyclus Ehrenbergi RALFS.	..	r+	..	..	..	..	..	..	r	r	..	+	r		
A. subocellatus (GRUN.) RATTR.	r	r	..	r	r	..	...	..	r						
Coscinodiscus excentricus EHRB.	r	..	..	..	r	..	..	..	+	r	..	r	r		
C. lineatus EHRB.	..	..	..	..	..	..	..	..	..	r					
C. curvatulus GRUN.	+	r	..	+	+	+c	..	r	r	r	r+	..	..	r	r
C. stellaris ROP.	..	..	..	..	..	..	..	..	r	..	..	..	r		
C. radiatus EHRB.	r	+	..	..	r+	..	..	r+	r	r	r	r+	+	..	r
C. subbulliens JØRG. n. sp.	..	..	..	r	r	r+	..	..	..	..	r				
C. centralis EHRB.	c	+c	+	..	+	r	..	..	r	r	r+	r			
C. concinnus W. SM.	r	..	r	r	r	r	..	r							
C. bioculatus GRUN.	+	..	..	r+	r	..	r	r	r	..	r	r	..	+	
Hyalodiscus stelliger BAIL.	..	..	..	..	..	..	..	..	r	..	..	r	r		
Nitzschia seriata CL.	r	+	+c	+c	+	+	r	c	c	..	+	..	..	r	

Year 1900. Month	April														
Locality	Skjerstadfjord IV	Skjerstadfjord V	Skjerstadfjord VII	Skjerstadfjord XII		Midværfjord	Seivaagen, Saltenfjord	Saltenfjord II		Foldenfjord	Foldenfjord I			Vestfjord, between Flade and Skroven	
Date	2/4	2/4	2/4	4/4	4/4	5/4	5/4	5/4	5/4	6/4	6/4	6/4	6/4	7/4	7/4
Depth (meters)	0—330	0—420	0—480	0—50	0—500	0—25	0—20	0—50	0—330	0—530	0—100	300—200	500—400	0—50	0—315
Salinity (‰)	34.04	33.85—34.04	—33.99	33.73—33.85	33.73—34.09			34.11	34.11—35.18		34.11—34.39	34.94—34.88	35.00—35.12	34.07—34.19	34.07—35.12
Temperature (Cels.)	3.2—3.15	2.4—3.15	—3.15	2.3—3.45	2.8—3.05			3.2—3.1	3.2—6.65		3.2—4.15	6.6	6.55	2.85—3.6	2.85—6.5
Nitzschia delicatissima Cl.	..	..	..	..	..	..	..	..	..	..	..	..	..	cc	
N. frigida Grun.	..	r	..	r	r	..	..	r	..	..	..	..	..	r	
N. hybrida Grun.	r	r	..	r+	r	r	..	..	r	..	r				
N. recta Hantzsch.	..	..	..	r	..	..	r	r	..	..	r				
N. longissima (Bréb.) Ralfs.	..	..	..	..	..	..	r								
Thalassiothrix nitzschioides Grun.	c	c	c	c	c	..	r	c	c	+	c	+	..	c	+
T. n. Grun. *f. curvata* (Castr.) Jørg.	..	..	..	..	+										
Fragilaria oceanica Cl.	c	cc	cc	c	cc	.	cc	cc	cc	c	c	r	r	cc	c
F. cylindrus Grun.	cc	cc	cc	cc	cc	c	cc	c	+c	..	+	..	..	cc	c
F. islandica Grun.	r	r	..	..	..	r	..	..	r						
Achnanthes tæniata Grun.	r+	r+	r	+	r	r	+	r	r	..	..	..	..	r	r
Pleurosigma Stuxbergi Cl.	..	..	..	..	..	r	r	r	..	..	r	r			
P. fasciola W. Sm. (incl. *P. tenuirostris* Grun.)	..	..	..	..	..	..	r	r	r						
Navicula Vanhöffeni Gran	..	..	..	r	..	..	r	r	r	r	r+	..	..	r	r
N. pelagica Cl.	..	r	..	..	..	..	..	..	rr						
N. directa W. Sm.	r	..	..	r	r	r	..	r	r						
N. kariana Grun.	r	..	r	+	+	..	r	r+	r	..	r	..	..	+	
Amphiprora (Tropidoneis) parallela Jørg. n. sp.	r	..	..	..	r	..	r	r	..	..	r				
Actinoptychus undulatus (Bail?) Ralfs	..	..	..	..	r	..	..	..	..	..	..	..	r		
Campylodiscus Thuretii Bréb.	..	r	..	..	..	..	r								
Surirella lata W. Sm.	..	..	..	..	..	..	..	..	r						
Rhabdonema arcuatum (Lyngb.) Kütz.	..	r													
Bacillaria socialis Greg.	..	..	..	..	..	r									
Pleurosigma angulatum W. Sm.	r	..	r												
P. Normanni Ralfs	..	..	..	..	..	..	..	..	..	..	r				
Rhoicosigma arcticum Cl.	..	..	..	..	r										

II. Peridiniales.
(Dinoflagellata).

Dinophysis acuta Ehrb., Jørg.	..	..	..	..	..	..	..	..	..	..	..	r	r		
D. norvegica Clap. et Lachm., Jørg.	..	..	..	r	..	..	..	r	r	..	..	..	r		
D. acuminata Clap. et Lachm., Jørg.	..	..	..	..	r										
D. rotundata Clap. et Lachm.	r	r	r	r	r										
Podolampas palmipes Stein	..	..	..	..	..	..	..	..	..	r					
Oxytoxum diploconus Stein	..	rr													
Pyrophacus horologium Stein	..	..	..	..	..	..	..	..	..	..	..	..	r		
Protoceratium reticulatum (Clap. et Lachm.) Bütschli.	r+	r	..	..	+	..	..	r	r						
Gonyaulax spinifera (Clap. et Lachm.) Dies.	..	..	..	..	r										
G. polyedra Stein.	..	rr													
Peridinium depressum Bail.	+	r	..	..	+	r	r	r	r	r	r	r	..	r	r
P. divergens Ehrb. (*P. lenticulare* (Ehrb.) Jørg.)	+	..	r	..	r	..	..	..	..	r	r	r	r		
P. conicum (Gran) Ostenf. et Schm.	r	+c	..	..	+	r	..	..	..	..	r				

Year 1900. Month	April														
Locality	Skjerstad-fjord IV	Skjerstad-fjord V	Skjerstad-fjord VII	Skjerstad-fjord XII		Midværfjord	Seivaagen, Saltenfjord	Saltenfjord II		Foldenfjord	Foldenfjord I			Vestfjord, between Fladø and Skroven	
Date	2/4	2/4	2/4	4/4	4/4	5/4	5/4	5/4	5/4	6/4	6/4	6/4	6/4	7/4	7/4
Depth (meters)	0—330	0—420	0—480	0—50	0—500	0—25	0—20	0—50	0—330	0—530	0—100	300—200	500—400	0—50	0—315
Salinity (°/₀₀)	34.04	33.85—34.04	—33.99	33.73—33.86	33.73—34.09			34.11	34.11—35.13		34.11—34.39	34.94—34.88	35.00—35.12	34.07—34.19	34.07—35.12
Temperature (Cels.)	3.2—3.15	2.4—3.15	—3.15	2.3—3.45	2.3—3.05			3.2—3.1	3.2—6.05		3.2—4.15	6.6	6.55	2.85—3.6	2.85—6.5
Peridinium pentagonum GRAN	..	r													
P. pallidum OSTENF.	r	r	r	r	r+	r	..	r	r	r	r	..	r		
P. ovatum (POUCH.) SCHÜTT	r+	+	..	r	+c	..	..	r	r	r	+	r	r	r	
Ceratium tripos (O. F. MÜLL.) NITZSCH. (α *balticum* SCHÜTT)	r	r	r	..	r	..	r	r	r	r	r+	r	r	r	r
C. bucephalum (CL.) CL.	r	r	..	..	r	..	..	r	r	+	r	r+	r	r	
C. b. v. *heterocampta* JØRG.	r	r													
Ceratium macroceros EHRB. (CL.)	r	r	..	..	r	..	r	r	r	r	+	+	r	r	r
C. intermedium (JØRG.)	r	..	..	..	..	..	..	..	r						
C. longipes (BAIL.) CL.	r	..	..	..	..	..	..	..	r	r	r+	..	r	+	r
C. furca (EHRB.) DUJ.	..	+	r	..	r+	..	r	..	r	r	r				
C. fusus (EHRB.) DUJ.	c	+c	r	r	r	+	r	r	r	r	+	..	r	r	r
III. Pterospermataceæ.															
Pterosperma Möbii (JØRG.) OSTENF.	..	r	..	..	..	..	..	r	r	..	r	r			
P. Vanhöffeni (JØRG.) OSTENF.	..	..	..	..	..	..	..	..	r						
P. dictyon (JØRG.) OSTENF.	..	..	..	..	r	..	r	..	r	..	r				
IV. Halosphæraceæ.															
Halosphæra viridis SCHMITZ (incl. *H. minor* OSTENF.)	..	+c	..	.	..	..	r	..	r	c	c	..	..	..	+
V. Flagellata.															
Phæocystis Poucheti (HAR.) LAGERH.	..	+c	..	c	..	..	..	..	r	..	..	..	..	ccc	c
VI. Silicoflagellata.															
Distephanus speculum (EHRB.) STÖHR	r.	r	..	r+	r	r	r	+	+c	..	r	..	..	c	
Dictyocha fibula EHRB.	..	..	..	..	r	..	..	..	r						
VII. Radiolaria.															
1. Spumellaria.															
Hexacontium enthacanthum JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r		
H. pachydermum JØRG.	..	..	..	..	..	..	..	..	..	..	..	r	r		
Echinomma leptodermum JØRG.	..	..	..	..	..	..	..	..	r	..	..	..	r		
Rhizoplegma boreale (CL.) JØRG.	r	r	..	..	..	..	..	..	r	..	..	r	r		
Lithelius minor JØRG.	..	..	..	..	..	..	..	..	..	..	..	r	r		
2. Acantharia.															
Radiosphæra anacanthica JØRG. n. sp.	r	r	..	..	r	..	..	..	..	..	..	..	r		

Year 1900. Month	April														
Locality	Skjerstad-fjord IV	Skjerstad-fjord V	Skjerstad-fjord VII	Skjerstad-fjord XII		Midværfjord	Seivaagen, Saltenfjord	Saltenfjord II		Foldenfjord	Foldenfjord I			Vestfjord, between Fladø and Skrovén	
Date	2/4	2/4	2/4	4/4	4/4	5/4	5/4	5/4	5/4	6/4	6/4	6/4	6/4	7/4	7/4
Depth (meters)	0—380	0—420	0—480	0—50	0—500	0—25	0—20	0—50	0—330	0—530	0—100	800—200	500—400	0—50	0—815
Salinity ($^0/_{00}$)	34.04	33.86—34.04	—33.99	33.73—33.86	33.73—34.09			34.11	34.11—35.13		34.11—34.39	34.94—34.88	35.00—35.12	34.07—34.19	34.07—35.12
Temperature (Cels.)	3.2—3.15	2.4—3.15	—3.15	2.3—3.45	2.3—3.05			3.2—3.1	3.2—6.65		3.2—4.15	6.6	6.55	2.85—3.6	2.85—6.5
3. Nassellaria.															
Plagiacantha arachnoides CLAP. et LACHM.	..	..	..	..	r										
Campylacantha cladophora JØRG. n. sp.	..	..	..	..	..	..	..	..	r	..	..	r			
Plectacantha oikiskos JØRG. n. sp.	..	..	..	..	..	..	..	..	r	..	..	..	r		
Phormacantha hystrix (JØRG.) JØRG.	..	r	..	..	..	..	..	..	..	..	..	r			
Gonosphæra primordialis JØRG. n. sp.	..	..	..	..	..	..	..	..	..	..	..	..	r		
Peridium longispinum JØRG.	..	r	..	..	r	..	..	r	r	..	..	r	r		
Cladoscenium tricolpium (HCK.?) JØRG.	..	..	..	..	..	..	..	..	r	..	..	..	r		
Lithomelissa setosa (CL.) JØRG.	r	r	..	r	r	..	..	r	r	..	r	r	r		
L. s. v. *belonophora* JØRG.	..	r													
Litharachnium tentorium HCK.	..	..	..	..	..	..	..	..	..	..	..	rr			
Dictyoceras acanthicum JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r		
Clathrocyclas craspedota (JØRG.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r		
Androcyclas gamphonycha (JØRG.) JØRG.	..	..	..	..	..	..	..	..	..	..	.	..	r	..	r
A. amblycephalis (JØRG.) JØRG.	..	..	..	..	..	..	..	..	..	..	..	..	r		
4. Phæodaria (Tripylea).															
Cannosphæra lepta JØRG.	..	r	..	..	..	..	..	..	..	..	r				
Protocystis tridens (HCK.) BORG.	r	r	..	..	r	..	..	..	..	..	r	..	+		
Challengeron diodon HCK. (*C. heteracanthum* JØRG.)	..	..	..	.	..	..	..	..	..	r	r	..	r		
VIII. Tintinnodea.															
Tintinnus acuminatus CLAP. et LACHM.	r	..	..	..	r										
Leprotintinnus pellucidus (CL.) JØRG.	r														
Ptychocylis urnula (CLAP. et LACHM.) BRANDT v. *subarctica* JØRG. n. var.	..	..	..	..	..	r									
Tintinnopsis nitida BRANDT	r	r	..	r	+c	..	r	r	r	..	r				
Cyttarocylis denticulata (EHRB.) FOL.	..	..	r+	..	r	r	r	..	r	+c	r	+c	+c	..	r
C. d. v. *subedentata* Jørg. n. var.	r	r													
Undella caudata (OSTENF.) CL.	..	r	..	..	r	..	..	..	r	r	..	..	r		

b. Remarks on the Plankton.

As mentioned in the introduction (p. 49), an evolution of large masses of diatoms in the plankton takes place early in the spring. This very conspicuous phenomenon I have called, the inflow of diatoms. (Ostenfeld: diatomébölgen, the wave of diatoms; Gran: Diatomeen-wolke.)

To explain „the large wave of diatoms, which every spring rolls over the North Atlantic", Ostenfeld (L. 112, p. 65) supposes that the currents have been in close proximity to the shore, for he considers that the evolution of the diatoms is enhanced, when such is the case; although he does not give his reasons for so thinking. As, however, this explanation will not do for all cases, he mentions that the same quickening force, as that of the shore, is found in the boundary lines „where different currents glide past each other."

Gran, in his latest work, has examined into the same phenomenon, more in detail. On the whole, he appears to agree with Ostenfeld, at any rate in so much as that the boundaries of currents and also coast water are necessary for production in large quantities, but he goes a step further and suggests a case for the effects observed.

He applies the theory recently advanced by Brandt, and considers that the explanation is to be found, either in the fact that in the open sea „there is a constant state of famine, as the supply of nourishment principally comes from the coasts; or else that there is a more active decomposition of nitrogeneous elements in the warmer waters of the Atlantic".

As to which of these causes is the more decisive, Gran does not give any definite opinion. But he seems most to incline to the famine hypothesis, for, from this starting point, he shows how the boundaries of the different currents must act in the same way as coast lines, by reason of the nourishing matter, which they bring with them, from the rivers of Siberia and the arctic coasts.

In connection with the foregoing, I will give a brief account of the opinions I have formed after my examination of the coast plankton; I will at the outset mention that I have had little or no personal experience of o c e a n plankton.

I also long since came to the conclusion that it is probable that the evolution of the large quantities of diatoms depends upon the mixing of the waters. On the whole, I am of the same opinion as Gran, as expressed in the quotation first given from his book. I must, however, make exception to the famine hypothesis, which appears to me to give altogether too hopeless a view respecting pelagic animal life.

When Gran, however, considers the resting spores (endocysts) left behind in the shallow coast water as the real explanation of the phenomenon, my experience makes it impossible for me to agree with him; in spite of the great attractiveness which at first attaches to this hypothesis. As is so often the case, so here, the same conclusions are often arrived at from widely differing hypotheses.

After Gran's theory the neritic diatoms with resting spores (in contradiction to the oceanic, which have none) leave behind these spores in the coast water after a short period of vegetation. When now the spores sprout, in the following spring they cause the production of the large masses of diatoms.

What I most object to is, that if this theory be correct there would be good reason to conclude that the „inflow of diatoms" is a local phenomenon, at any rate in the fiords. One ought then to be able to conclude that the plankton which flourishes in o n e fiord would be considerably different from what is to be seen in another and distant one.

It would, moreover, be reasonable that the large evolution would occur in one fiord essentially earlier or later than in adjacent ones, according to the different local conditions, which might tend either to hasten or hinder the development of diatoms.

But everyone who has carefully examined the make-up of the plankton at the time mentioned will have particularly noticed that, taken as a whole, there is a remarkable uniformity in the plankton.

Of course, there are variations, but these appear to be caused more by differences in time than place.

It should, however, here be remembered, that the plankton during „the inflow" is very rich also as to quality, and contains — especially that of the northern inflow — so many forms difficult to determine (small and with thin walls imperfectly silicated) that it must still be considered too little known.

In spite of the large number of species, and notwithstanding that there doubtless are still many unknown ones, it seems to me that there is such remarkably great uniformity that it is difficult to think of the phenomenon as a local one.

As mentioned at the commencement, however, there is some difference between the southern and northern inflow; and this difference would seem to be constant in the case of a few species. It is highly probable that there is a much greater difference in the quality than can now be seen; for, as before mentioned, the number is large of those species which it is difficult to determine. If, however, considerations be confined to the predominant species, it will be found that there are some which have hitherto only been found in the northern, and not in the southern plankton. For instance, Gran long since emphasized the fact that *Chætoceros furcellatus* „is entirely absent south of Stadt, and *C. cinctus* takes its place."

It is also remarkable that the phenomenon occurs simultaneously at different places. If the inflow is seen in one fiord, it will also as a rule be found everywhere in the district. It is indeed quite difficult to decide whether it has come from the south or the north, that is to say, whether the inflow is at the same time observable in places to the south, and not in places to the north, or vice versa.

Here let me call attention to the rapidity with which the inflow sets in — for this I consider to be an especially noteworthy and important circumstance. There is no clearly defined time when the change takes place in the plankton and the inflow is prepared for, but it all happens, so to say, with a bound.

The species which form the bulk of the inflow are, — as previously stated by Cleve and Gran — for the most part quite different ones from those which are generally found in the plankton, and most of them are arctic forms. This — in addition to several other circumstances — is the reason why Cleve has supposed that there is a current of arctic water along the coast of Norway, right away down to Skagerak and Kattegat.

According to Gran's theory, the foreign arctic forms must be considered to come from the resting spores which have been deposited, and so must not be looked upon as foreign, but as species which now on our coasts have an unusually short period of vegetation in the spring, remaining otherwise in rest at the bottom as spores.

It will clearly be seen, from the tables of the species which have been found in the plankton here dealt with, that a large number of foreign species occur during the period of the inflow, partly being decidedly high arctic, at any rate as far as their distribution is now known. Of such species, I would particularly mention *Thalassiosira hyalina*, *Fragilaria cylindrus*, *„Navicula" Vanhöffeni*, *Coscinodiscus bioculatus*, *Pleurosigma Stuxbergi*, *Nitzschia frigida* and *Chætoceros furcellatus*.

These two things — the great uniformity and the foreign character — taken in connection with each other seem to me most naturally to give rise to the supposition that those species, which form the bulk of the plankton at the time when the masses of diatoms appear, are brought in from the ocean by arctic water, and that they are — perhaps by mixing with the waters of the Atlantic — brought into better conditions of existence and therefore multiply by division. This way of generation will of itself — that is to say when such division is not only the exception — easily lead to production en masse, as one has good opportunities of seeing during the development of diatoms, when artificially cultivated.

What constitutes the improved conditions of existence, is another question, and there is no reason for me to deal with this matter here, as I have no observations to fall back upon, but there cannot be very many factors to take into consideration. Gran supposes that the rich supply of nourishment is its cause (cfr. the foregoing.)

In this connection, I will only observe that from his standpoint Gran explains that the reason why the development of the large masses stops of itself, and why the masses disappear, is that the nourishing matter has been quickly used up. According to my experience light plays an important part in the culture of diatoms, their development being greatly assisted by a certain degree of light, while a somewhat greater degree has precisely the opposite effect. One might, therefore, perhaps find a reason in this fact for the disappearance of the masses, in as much as long periods of sunshine might destroy the assimilating powers of the chromatophores.

It is highly probable that the phenomenon is due to both these causes.

This disappearance of the masses of diatoms may, however, be local, and be caused by the rushing in of other water (cfr. the concluding remarks on the Baltic current.)

I have called the phenomenon the inflow[1]) of diatoms, partly because it conveys the immediate impression of an inflow from outside, and partly because I really consider that it is caused by the bringing in of foreign forms. It is, however, only necessary to consider that the germs for the evolution of the masses of diatoms are thus brought in, whether it be light, temperature, nourishing matter, or most likely all three factors combined, which further their development.

As already mentioned, the southern inflow appears always to contain some species which are not found in the northern, so it would seem likely that the western coast of Norway partly receives water from another quarter than the northern coast. Gran apparently considers Stadt to be the boundary line for some of the characteristic species.

This, I think, makes it clear, that it is of some importance to try to discover whether there is really any variation or not year after year in the species found in the inflow of diatoms. On the whole, it seems to me that the great difference of, and changes in the interpretation of the plankton at least show that it has not yet been sufficiently studied to make any quite reliable basis for hydrographical conclusions.

As is the case with the majority of biological phenomena, the development and changes in plankton are of such a complicated character that a knowledge of many factors which work together, and which as yet we are partly quite unacquainted with, is necessary, so that to get a clearer conception and better knowledge of the many remarkable phenomena, which are to be found in our coast plankton alone, will give enough work for many years.

Before I leave this subject, I think I ought to better explain my position with regard to the hypothesis of resting spores, which at first sight, it must be confessed, seems to give an attractive explanation of many phenomena.

When Gran considers the neritic species to be characterized by resting spores, in contradiction to the oceanic species which have none, this distinction seems to me in a sense to follow of itself, but contains no proof of the „over summering", by resting spores on the bottom. I look upon these spores as a means by which the individual diatom attempts to escape from unfavourable surroundings, as the specific weight increases. So far, I agree with Gran. His supposition that they often sink to the bottom is doubtless also correct in very many cases, in fact I think this is finally most often their fate in the coast water. But I think it is just as certain, in the majority of cases, that the individual to begin with is only forced into underlying water of a greater specific weight. What its further fate will be, depends entirely upon circumstances. If it thrives, it will live on, and possibly multiply. If, however, it does not thrive, the final result will be that it reaches the bottom. Then, as a rule, it will be altogether played out, at the most, it might be included in a preparation of bottom material.

In an earlier paper (L. 92) I have suggested that the thickening of the horns in certain *Chætoceræ* (e. g. *C. convolutus*, *C. contortus* and many others) might be a biological phenomenon corresponding to the formation of resting spores, although the latter are undeniably more effective.

In his last work, Gran also mentions (L. 70, p. 129—130) numerous dead cells and resting spores from a deep water sample (The Stor Fiord, Søndmøre, stat. 3, 200—530 m.), these consisting partly of species which had disappeared from the surface. How these could — even if they remained alive — again come up from such great depths, is really difficult to explain, unless too arbitrary suppositions be resorted to. Besides, the greater depth, implies little light, but light is an absolute condition of vital importance for the diatoms. The fact that bottom samples from deeper than 50 m.s show a very poor diatom life, is very instructive in this connection; while a very rich diatom flora may be found at lesser depths. At depths of under 100 m.s the bottom flora of diatoms consist only of empty valves of pelagic species plus some other matter, also a few diatom valves, which has been washed down from the shore and here too resting spores are found in varying

[1]) It is useful in the remarks on the species to have a special name to designate this period.

quantities. Such has at any rate been my experience. On the other hand I have never seen any large number of resting spores in shallow water.

If they survived the summer here, one ought in the succeeding year to find quantities of the same species which were numerous in the preceding one; and consequently a considerable uniformity year after year. But, according to my explanation, one would expect greater variation.

The oceanic species live under conditions which are subject to but little change. The changes which do take place, occur as a rule slowly and gradually, so that at length a point is reached when it is a question of whether or not.

If, on the other hand, an oceanic species comes into coast water, or into a boundary district between two currents a formation of resting spores might take place, if the species in question had the requisite power. But in such cases, Gran does not consider it to be an oceanic species (but a neritic one). In this way, one, of course, gets as clearly defined a distinction, between oceanic and neritic species, as can be wished for; but such a distinction is at any rate highly artificial and seems to me to be of little use, if Gran's interpretation of the resting spores is not correct. Besides, I think that the most important question is, whether a given species can propagate and thrive in the open sea, and this may be the case even if it is possessed of the power of forming resting spores. According to my opinion with regard to them, it might in some cases just be the coast water which is an hindrance, and the oceanic water which is furthering.

At any rate, it ought first of all to be clearly proved that the resting spores are deposited in large quantities at the bottom of shallow water, and this should not be a very difficult matter. Deep water can scarcely be taken into account, nor yet those spores which have been washed further down than about 50 m.s beneath the surface, to mention a figure which would seem to suit. There must, I take it, be great quantities of resting spores present to explain the sudden appearance of large masses of diatoms.

My experience — as mentioned above — goes to prove that it is just only in deep water that large quantities of resting spores are found, and here, as explained above, one must expect to find them. I have not, however, by direct experiments, become convinced that essential quantities of them do not occur at the bottom of shallow water, and I will, therefore, in this connection, mention that it is quite likely that the usual method of preparing bottom samples gives a negative result, even if they do contain such spores.

When I above threw out the suggestion, that the heavier spores serve to force the individual into deeper water, I do not wish to be understood to mean that their special or only purpose is to make the individual diatom heavier. It is also reasonable to suppose that the formation of resting spores may be a reaction to plasmolysis, caused by salter water. This thought, would, it seems to me, explain certain phenomena of the plankton, although I will not now at present venture to say that this reason is the more decisive. I have not yet sufficiently studied this subject (the formation of resting spores).

As it is always unsatisfactory to attack a given hypothesis — especially one such as this of resting spores which seems to rejoice in numerous adherents — unless another be offered in its stead, I will now mention how I consider the inflow of diatoms occurs.

If I have understood hydrographers correctly, there is, on the surface during the winter months, a tongue of salt water, which flows northwards, fairly parallel to the coast of Norway from the passage between the Færoe Islands and Shetland. This tongue seems to be comparatively narrow, especially a little to the north or north east of the passage, and it expands northwards, until at its most northerly end — in the neighbourhood of Bären Eiland — it divides into two or more arms.

On the right of this tongue of ocean water, there is the coast water off the coast of Norway; on its left, there is the arctic water (nearest to the Faeroe Islands it is the East Icelandic Polar Current). This (easterly) tongue of ocean water is displaced and forced in different directions by the water from the arctic regions, now nearer to the coast of Norway, then in the contrary direction; and it varies in its distribution northwards (or is mixed in different proportions with the arctic water).

In the spring months, there appears to be a rich diatom plankton just in the boundary line between this arctic water and that of the Atlantic. This phenomenon may partly be caused by a purely mechanical crowding where the velocity of the current is lowest; but it is also very likely that the somewhat higher temperature of the mixed water may promote the evolution of the diatoms.

In Gran's last work (L. 70. p. 158, 160) one learns from the expedition of S/S Heimdal, in May 1901, that there was found in the southern section of the „Gulf Stream" (the previously mentioned tongue of ocean water from Faeroe—Shetland northwards) a rich diatom plankton on both sides of the stream, especially on the western towards the Icelandic polar current. Traces of a similar state of things were found in the second section, much more northerly, but it was here little noticeable (at that time of year).

Gran himself mentions that on the western boundary of the Gulf Stream, a rich neritic plankton consisting of diatoms was found, and this he considers to have been brought hither by the current, probably from the Faeroe Islands. He also mentions that the same state of things has several times previously been noticed at about the same place and time. With regard to the northern section, he hints at an exceedingly long transport of the same neritic forms northwards to the corresponding boundary line there.

In this connection, it would be of importance to know whether such an evolution of masses of diatoms takes place in other places on the boundaries between the atlantic and arctic waters, (at a time which is favourable to the development of diatoms, probably excluding the winter months of December, January and February, and perhaps partly also March) or if this production en masse is confined to those places where coast water is present. It is quite likely that the latter is the case, but one can hardly say that it has, as yet, been clearly proved.

If such mass development should be found in the boundaries as a whole, one of the principal reasons would disappear for considering as neritic such arctic diatoms as have been found repeatedly in large numbers in samples of plankton which have been taken far from the coasts.

As the tongue of ocean water above mentioned is narrow and varies in its situation and expanse, it is reasonable to conclude that, occasionally during the spring months, the arctic waters wash over it, and become in this way transferred to the coast of Norway.

To judge from the occurence of the diatom inflow, this would seem to happen regularly at the end of March. (In 1898 particularly early, namely in the middle of the month, or perhaps still earlier.)

By assistance of Mr. NORDGAARD I have been aware that such a washingover by the arctic waters across the Gulf Stream has really been observed by the Swedish hydrographers (PETTERSON, L. 119), and that just in the year 1898 the East Icelandic Polar Current by a broad zone went across the Gulf Stream towards the Norwegian coast. The Swedish hydrographers also suppose the arctic water to force its way beneath the surface all into the Skagerak and Kattegat, and CLEVE thus explains the appearance there of arctic planktonforms. They appear here earlier in the year than at the Norwegian coast.

When the arctic water reaches the coast, we find at once the masses of diatoms, which have already been developed on the boundaries.

As the preceding remarks will show, the southern inflow of diatoms, according to my opinion, is especially due to the East Icelandic Polar Current, which under favourable circumstances advances in the direction of somewhere near the Sogne Fiord. (As previously mentioned, GRAN makes Stadt the limit for some of the arctic diatoms, which in this connection are of special importance). It is possible that a similar washingover occurs regularly (by a very broad wave?) further north on the coast of Lofoten (to the south or north). Here, at certain times, a tongue of arctic water also seems to be pushing its way across the Gulf Stream.

I think it very possible that the specific northern forms in the northern diatom inflow may, in this way, be brought in with water from about the latitude of Jan Mayen. It is, however, also quite likely that it is the previously mentioned tongue of arctic water, transversing the Gulf Stream at its narrowest part, which alone gives rise to both the northern and southern inflow.

If such be the case, one might expect that the southern one would expand southwards, and the northern northwards. There would still be nothing to prevent the slight differences in their components, as the northern part of the current could bring with it the specific northern forms, if from land, then from Jan Mayen or perhaps East Greenland.

The abundant material for observation which CLEVE has collected in his splendid work on the distribution of plankton organisms in the Atlantic, (L. 40), makes it possible for one to get a view of the distribution of the species. The specific northern forms may, in accordance with the information there given, be supposed to come from East Greenland or Jan Mayen.

If the northern diatom inflow be due to the rushing in of a northern tongue of arctic water at Lofoten or thereabout (probably in a wide expanse) one might expect the inflow from here to stretch southwards on the one side, and in a north easterly direction on the other. There was indeed, in the plankton examined, a reason for the suggestion that the diatom inflow extended in an easterly direction in the most northern part of Norway.

Following close upon the inflow of diatoms, there is, on the south west coast of Norway in the neighbourhood of Bergen, a very sudden transition to much fresher water, containing a rich and peculiar plankton of *peridinæa*, which quickly takes the place of the masses of diatoms. (Cf. E. JØRGENSEN L. 91)

This is due, as far as I know, to the Baltic current which now rushes in and sweeps the masses of diatoms out from the coast and northwards. Therefore, it is reasonable that the characteristic northern species cannot penetrate so far as to the latitude of Bergen.

In the above mentioned southern section of the Gulf Stream, during the expedition of S/S Heimdal in 1901, there were also masses of diatoms on the boundary towards the oceanic water in May, just at the time when the Baltic current has swept away the diatom masses from the coast near Bergen.

There is a certain correspondence between the characteristic northern forms in the northern diatom inflow and the species which from GRUNOW's and CLEVE's works are known from the Kara Sea and the north coast of Siberia. This might mean some kind of connection between these seas, and one might easily be tempted to conclude that water from the north coast of Siberia finds its way to the north coast of Norway.

In GRAN's last work, a plankton sample is mentioned as taken during the expedition of S/S Heimdal in 1900 in the Barents Sea, west of Waigatch, and which contained several of the peculiar forms found in the northern diatom inflow.

GRAN has kindly placed this sample at my disposition, and after a thorough examination of it, I can affirm, that it contains a large number of our northern plankton diatoms. On the other hand, there are also so many foreign elements that it is scarcely likely that water from this district flows to our coast during the period of the diatom inflow. On the contrary, everything (also the date $^{31}/_{5}$) suggests that the masses of diatoms from the coast of Norway (or the same inflow which gives rise to the northern inflow with us) extend further eastwards (perhaps to the Kara Sea).

The species found in plankton, and their distribution (principally in the nearest seas) and remarks on the new or critical forms.

I. Bacillariales.

(Diatomaceæ).

The suggestions which have hitherto been made as to a natural classification of diatomaceæ are all more or less unsatisfactory. In the following pages, I have principally availed myself of the system used in Van HEURCK's „Traite des Diatomacées“ (L. 89); but in the larger groups I have made some changes which I have found to be necessary.

A more complete list of literature will be found in my previous paper (E. JØRGENSEN: Protophyten und Protozoen aus der norwegischen Westküste) (L. 91). Here I have only more completely cited the literature for the forms which are not referred to there.

I a. Centricæ SCHÜTT.

1. Coscinodisceæ.

Under the heading „distribution“, I have used the ordinary expressions „oceanic“ and „neritic“ forms (= sea and coast forms). As long as one (for diatomaceæ) does not know anything definite about any rest period at the bottom, these expressions are far preferable to „holo“- and „meroplanktonic“.

In accordance with my opinion as stated above respecting the inflow of diatoms in the spring I consider a large part of our plankton species to be brought in from outside.

There are others which occur all the year round on our coasts, although these of course also follow with the various currents.

Such species are noted as native, or sometimes as „stationary", on our coasts.

So as not to differ more than necessary from the expressions commonly used, I have called boreal those coast forms which are stationary on our northern coasts, as well as those which, according to my opinion, come to us from the northern, but not exactly the arctic, districts. (This expression — boreal — was first used by Cleve, and later by both Gran and Ostenfeld with a similar meaning). Moreover, I have, as Gran has done, widened this expression to include certain oceanic forms, which are found in the northern Atlantic outside the arctic water proper. After my view, such forms will for the most part be those which thrive in the boundary lines between the arctic water and that of the Atlantic, and which are well able to bear the latter (up to a certain degree of salinity and temperature).

That it is often difficult to decide whether arctic and boreal (I would prefer to call the latter subarctic) forms are neritic or oceanic, is something which is a necessary result of my opinion that they thrive well and may give rise to evolution en masse in the boundaries between the arctic and Atlantic waters. It is this fact which has also been referred to by some authors when saying, that these boundaries to some extent play the same part as the coasts.

Coscinodiscus Ehrb.

It will be seen, from the various plankton tables which have been published, that this difficult genus has given rise to much confusion. The names which are used in many cases evidently mean quite different species. As there, however, in our latitude, does not appear to be very many species in the plankton, it ought to be possible to arrive at comparative clearness concerning them. It is probable that in reality there are many more species than have up to the present been found; but there are only a few which occur frequently.

I will here give a brief survey of the species which I have mentioned in the plankton tables.

Key to the species of Coscinodiscus.

Valve flat or nearly so (sometimes suddenly descending at a narrow zone of the outmost margin).

Marginal apiculi present (always distinct).

The characteristic structure of *C. curvatulus:* valve by (somewhat curved) radii divided into a considerable number of sectors; markings (areoles) in each sector in rows parallel to the one limiting radius (or somewhat convergent towards the border) .... *C. curvatulus.*

The characteristic structure of *C. lineatus:* markings arranged in more or less straight rows (in 5 or 6 directions) across the valve.... *C. lineatus.* (et var.)

The characteristic structure of *C. excentricus:* markings in 7 fasciculi, forming distinct secondary curves, concave towards the border..... *C. excentricus.*

Fine radiating structure with more or less distinct and numerous fasciculi .... *C. bioculatus.*

No marginal apiculi.

Structure of the valve rather coarse, more or less distinctly radiate (only near the border with more or less visible fasciculi, consisting of rows converging towards the border, sometimes apparently inordinate); markings near the border suddenly much smaller .... *C. radiatus.*

Valve decidedly convex (in *C. decipiens* with high broad marginal zone, then flat).

Valve without close markings all over the surface, only with distant puncta. *C. nitidus.*

Valve with close (more or less distinctly polygonal) markings.

Fine structure (fasciculi); around the centre of the valve a conspicuous star consisting of about 5 coarse marks .... *C. stellaris.*

Structure similar to that of *C. excentricus*, but with more quickly diminishing markings and long marginal apiculi .... *C. decipiens.* (= *Thalassiosira gelatinosa).*

Structure radiate, with more or less branched radii. No coarse marks; marginal apiculi (when present) short and small.

2 comparatively large (short linear) asymmetrical and numerous small marginal apiculi (which are often very inconspicuous or apparently wanting).

Fine structure. Smooth central space or large central rosette of several times larger areoles. Valve thin ..... *C. concinnus.*

Coarser structure. At the centre a definite central rosette of doubly large areoles. More strongly siliceous..... *C. centralis.*

No marginal apiculi.

Valve very thick. Coarse structure; areoles of very varying size on one and the same valve, from $^2/_3$ of the radius somewhat smaller. Comparatively broad, coarsely striated, border *C. subbulliens.*

C. excentricus Ehrb.

The form which occurs in the plankton from the northern coasts of Norway, is the typical one which is figured in Schmidt's atlas, (L. 128), pl. 58, f. 49.

Distribution: Appears to be a northern temperate oceanic form. On the west coast of Norway it is found all the year round, but only occasionally in somewhat greater number. The same seems to be true of the northern coasts, at any rate in the months February—May. Otherwise widely distributed along the coasts of the Atlantic, the North Sea and Skagerak right up to Greenland and Jan Mayen. Has, according to more or less reliable statements, a much wider distribution and is perhaps cosmopolitan.

C. lineatus Ehrb.

The easily recognizable form which is figured by Van Heurck (Synopsis, L. 88) t. 131, f. 3, I hardly think occurs on our coasts. But rarely one finds a form with fine structure and more or less straight secondary curves, which I have entered in the plankton tables under the name of *C. lineatus* var. I am, however, partly inclined to think that the specimens I have observed may be forms of *Coscinosira polychorda* Gran. Cfr. remarks concerning this species.

Distribution: The genuine *C. lineatus* Ehrb. is perhaps only found fossil and in the warmer seas.

C. decipiens Grun.

Vide *Thalassiosira gelatinosa.*

C. curvatulus Grun.

Rare on the coasts of Norway, occasionally more frequent in the northern coast plankton.

Distribution: Occurs in many forms, which taken as a whole have a wide distribution. It seems to be frequent on the arctic coasts. (Greenland, Jan Mayen and Franz Joseph's Land). Is perhaps an arctic and boreal oceanic form.

C. stellaris Rop.

Rare on the northern coasts of Norway. Does not appear to belong to the diatom inflow, and is mostly found singly in deep water samples.

Distribution: Rare on the coasts of the Atlantic and the arms of the sea in connection with it. On the west coast of Norway most abundant in the winter. Also known from the Mediterranean. The appearance of *C. stellaris* in the north, suggests that this species is a temperate Atlantic one (and probably oceanic.)

Note. *C. symbolophorus* Grun. (L. 83, p. 82, pl. 4, f. 3—6) is a very nearly related species with considerably coarser structure and different distribution. According to Rattray (L. 124, p. 493) transitional forms to *C. stellaris* occur. *C. symbolophorus* is an arctic and antarctic species (also known from several fossil deposits), which occurs on the west coast of Norway during the inflow of diatoms together with arctic species. In the northern plankton I have also seen it once: 6/4 1900, Foldenfjord, 0—100 m.

C. bioculatus Grun.

Grun. L. 83, p. 55, pl. 3, f. 30. Cleve L. 26, p. 10, t. 2, f. 13. *Thalassiosira bioculata* (Grun.) Ostenfeld L. 116, p. 504, f. 120, 121 (?).

This beautiful species, which does not seem to have been found before on the Scandinavian coasts, occurred in several of the samples, especially in 1900, sometimes rather numerous. It is only found during the inflow of diatoms in the spring months.

It is probable that this is the same species which is mentioned by Ostenfeld from the Faeroe Islands (l. c.), and which he has found in chains similar to those of *Thalassiosira*, for which reason he refers the species to this genus as a new subgenus, *Coscinolauderia.*

I have not followed Ostenfeld's example, partly because the genus *Thalassiosira* is getting to be rather heterogeneous and unnatural on account of the newer elements which have been added to it, so that there will soon be nothing left as a reliable distinguishing feature except the mucilaginous thread; partly too because I have not met with any such chains in my material, in which the species, however, never occurred in any important quantity. Perhaps we may be speaking of two different species, although Ostenfeld's figure considerably resembles our species. (The only thing which seems foreign to it, as far as I can see, is the apiculi which are closer and smaller than in our form, and also the lower cells, as I have only seen high ones).

Distribution: Arctic and boreal, according to Cleve (arctic) neritic species, known from the coast of North Siberia, ice near Novaja Zemlja, Greenland, the Faeroe Islands (April—May rare, Aug.—Sept. 1902 numerous, according to Ostenfeld, l. c., who also mentions it from several places in the N. Atlantic).

Note. *Coscinodiscus polyacanthus* Grun. (L 48, pl. 7, f. 127) is a little known and somewhat doubtful species, which occurs on the North Siberian coast and at Franz Joseph's Land. In a sample from Fölstad, 4/4 1899, 0—3 m., I found very sparingly a species, which in every respect seems to agree with authentic specimens of *C. polyacanthus* from Jamal (Swedish expedition to Jenessey 1875, slides in possession of the Riksmusæum, Stockholm). (Cfr. under *Coscinosira polychorda).*

C. polyacanthus Grun. var. *intermedia* Grun. (l. c. p. 81, pl. 3, f. 25) is probably another species, if it does not belong to *C. curvatulus* (it has, like this species, interfascicular apiculi). Specimens quite answering to the figure and description of Grunow were found sparingly in a sample from Skjerstadfjord XII, 4/4 1900, 0—500 m. Known from Cape Wankarema.

C. radiatus Ehrb.

Exceedingly variable. There are, however, certain distinctive marks by which all forms belonging to this species can be recognized. Gran (L. 70, p. 166) has already well characterized this form: — low („coinshaped") cells, flat valve, markings near the border suddenly very small.

The larger forms have a distinct central rosette and often areoles, which increase in size nearly up to the border, and are then *C. oculus iridis*, Ehrb., as this very much disputed species has been described by Grunow and Rattray. From these forms (cfr. Schmidt's atlas, (L. 128) pl. 63, f. 6., which form, however, has larger marginal areoles than usual) there seems to be every transition to the ordinary *C. radiatus* without the central rosette and with markings which are of about the same size nearly up to the border. Grunow (L. 83, p. 25) also observes that *C radiatus* passes into *C. oculus iridis*, but it must be mentioned that he seems to give little or no weight to the convexity of the valve (when this is not particularly conspicuous), and therefore he classes together

forms which are alike in structure only, while they, in other respects, can hardly be considered to belong together.

When thus GRUNOW further remarks that there is the most complete transition between *C. asteromphalus* and *C. oculus iridis* and further to *C. radiatus*, and when on the other hand he looks upon *C. centralis* as a variety of *C. asteromphalus*, he has surely gone too far.

On the other hand, there are thick walled, small, coarsely structured forms, which have quite a different appearance to the ordinary *C. radiatus*, and yet which must also be entered under this species. Such forms are *C. devius* A. SCHM. (L. 128) pl. 60, f. 1—4 = *C. radiatus f. minor* A. SCHM. (L. 127, pl. 3, f. 34.)

I have, strange to say, never yet seen any really good drawing of this characteristic species. As it is, however, — as indeed is the case with all species of *Coscinodiscus* — very difficult to figure properly, I must at present give up the thought of giving any figure of it.

CLEVE's meaning with regard to *C. radiatus* is not quite clear to me, as he (L. 40, p. 321) refers to SCHMIDT's atlas pl. 60, f. 9, which does not appear to be at all a characteristic figure of *C. radiatus*, as this species is looked upon by GRAN and myself. CLEVE refers too to GRUNOW's remarks in Diatomeen from Franz Josef's Land (L. 83, cfr. above) and mentions in Phytoplankton (L. 27, p. 23) that *C. radiatus* is scarcely more than a little form of *C. oculus iridis*. CLEVE's opinion of the latter species does not, however, coincide with GRUNOW's and RATTRAY's. For further particulars see *C. subbulliens*.

Rather common. More abundant in deep water samples than on the surface.

Distribution: Rather common all the year round on the coasts of Norway, both the western and northern. Also widely distributed on the European coasts of the Atlantic and its arms, right up to the arctic coasts (Greenland, Jan Mayen, Spitzbergen and Franz Joseph's Land.)

C. centralis EHRB., RATTR.
(Pl. VI, fig. 1).

RATTR. L. 124, p. 555.

This species is very easily recognized, but has been confused with *C. oculus iridis* and *C. concinnus*. It is sometimes not so easy to distinguish it from the latter species, and it is possible that one will not be able with certainty to keep them separate; but the difference from *C. oculus iridis* in (GRUNOW's meaning) as well as from *C. radiatus* is very considerable.

The characteristic marks of the species are the following:

Valve considerably convex (pl. VI, f. 1). Structure radiate with dichotomously branched radii and rather coarse structure (though finer than that of *C. radiatus*). The markings from a rather large central rosette of even size to $^2/_3$ radius, then gradually somewhat smaller (not suddenly small near the border). Near the margin numerous fine apiculi (in a single row) and with about 120^{0}s space between them. Besides two much larger, short linear, unsymmetrical, marginal ones.

Varies considerably in delicacy of structure and so often closely resembles *C. concinnus*, in common with which species it has the 2 characteristic unsymmetrical marginal and the numerous small submarginal apiculi. These latter may be indistinct, and sometimes (but rarely) not to be found at all, especially when the structure is rather coarse.

CLEVE, who also occasionally mentions *C. centralis* as occurring in the plankton, seems to regard this species as a less distinct form, as a transition between *C. concinnus* and *C. oculus iridis*. As a type for the latter species he quotes (L. 40, p. 319) *C. asteromphalus var. hybrida* GRUN. Franz Joseph's Land (L. 83) t. 3, f. 9. This may perhaps show that CLEVE considers those forms of *C. centralis* which are without distinct marginal apiculi and are of a coarser structure to be *C. oculis iridis*.

In the important work before mentioned on the distribution of species of plankton in the Atlantic (L. 40), the name *C. centralis* is omitted, the coarser forms probably being reckoned as *C. oculus iridis*, and the finer, with marginal apiculi, as *C. concinnus*.

With respect to difference from *C. concinnus*, reference is made to this species, where the structure is more particularly mentioned. Moreover, there appears as a rule to be great differences between the two species in the living plankton; *C. concinnus* developes cells, which are high with very thin walls and consequently very easily altered in shape, and with a strongly convex marginal zone, while *C. centralis* has rather low, thickwalled, firm cells, more flatly ascending towards the centre.

As before mentioned, it sometimes — but only seldom, judging from my experience — seems to be difficult to discern between *C. concinnus* and *C. centralis*, and GRAN (L. 70, p. 167) seems to suppose that the difference depends upon variation in salinity and temperature. My impression is, that they are two comparatively young species, but that they have already sufficiently distinguishing characteristics to enable them to be dealt with as specifically different forms.

This species and the *C. radiatus* are the most frequent of this genus with us.

Distribution: Appears to be widely distributed along the northern European coasts of the Atlantic and its arms. Rather common on the coasts of Norway, both on the west and north. Occurs right up to the arctic coasts but appears chiefly to be a temperate species.

C. concinnus W. SM.

The characteristic form of the living cell is illustrated by OSTENFELD (L. 116, p. 566). Its structure is always very fine, much finer than usual in *C. centralis*. The central rosette has very large areoles.

As a distinguishing feature from *C. centralis* the areoles in the central rosette are several times larger than the others, those in *C. centralis* being only twice as large, or sometimes but very little larger. I am, however, not sure if this difference is always to be found. Besides, the areoles in *C. concinnus* are „little marked“ (cfr. GRAN L. 70, p. 168) with comparatively broad hyaline spaces between them, and from the marginal apiculi there are similar rather broad, hyaline stripes radiating inwards at some length on the valve. These hyaline radii give the valve a highly characteristic appearance, which *C. centralis* does not possess.

Distribution: On the whole, the same as that of *C. centralis*, but seems to be still more extended. Seems to be rare on the arctic coasts. On the west coast of Norway frequent in spring and autumn, especially in the spring inflow. On the northern coasts of Norway rare, at any rate in the months January—May.

C. subbulliens n. sp.
(Pl. VI, fig. 2.)

Form: — The valve is clearly convex, with an evenly rising marginal zone. Seen from the side, its contour is almost straight with an angle of between 30 and 40°. The central part (to $^1/_2$ or $^3/_5$ of the radius) almost flat or often somewhat depressed.

Margin: — Clearly defined, broad and sharp, with coarse stripes.

Structure: — No central space. Generally either without or only with a slight indication of central rosette, consisting of a few larger polygons, without any regular arrangement in rosette shape. On larger specimens, a more distinct rosette with five larger areoles, having their narrower ends directed inwards.

The majority of the areoles increase slowly in size from the centre (outside the few larger central areoles) to $^1/_2$—$^3/_5$ of the radius where they are largest. From here they suddenly become much smaller (although not very small) and are about of equal size right out to the margin. All over the valve — both in the central part and further out — smaller areoles are strewn between the larger ones, and this often strongly resembles the structure of *C. bulliens* A. Schm. (hence its name).

Markings polygonal, thick walled with very plain „papillæ". Structure irregularly dichotomously radiate: From the centre numerous radii diverge, generally 2 or more being parallel. In the spaces between such rows of rays, new radii spring out, the first areole often being small. Where the cells have reached their greatest breadth, two new rows often spring out. Here and there, close to the margin, short new rows again fill up the intermediate spaces.

Size: — Rather small, considerably smaller than *C. centralis*, about equal to a little *C. radiatus* in size. Diameter usually 50—100 μ.

The living cell is of medium height, higher than in *C. radiatus* and generally much lower than in *C. concinnus*.

The central areoles, when they are found to be well developed, are 3 × 4 μ.

The areoles outside the central rose 4 on 10 μ, the largest 3,5 μ broad, 2—2,5 μ at the border. Here and there much smaller areoles, 1,5—2 μ.

At the border $5^1/_2$—6 stripes on 10 μ (corresponding to the same number of areoles). The margin 3 μ broad (the areoles being nearly cubic-cylindrical).

This species, which, judging from my experience, is well defined and easily recognisable, resembles the *C. radiatus* most nearly, and may, unless great care be taken, be confused with it; the convex valve and the absence of the very small areoles near the margin will, however, at once show the decided difference.

This species is also Gran's *C. oculus iridis* after his interpretation of this species in Plankton des norwegischen Nordmeeres (L. 70, p. 168), as I have had an opportunity of being convinced of, on comparing some of his plankton samples.

Cleve's *C. oculus iridis* appears to consist in a great measure of this species, judging from his plankton lists, but as he — as above mentioned — refers to Grunow's figure of *C. asteromphalus var. hybrida*, which is hardly specifically different from what Grunow considers to be *C. centralis* Ehrb., it seems to me that Cleve's species must consist of forms which are specifically different from each other.

Grunow's *C. centralis*, which he considers a variety of *C. asteromphalus*, is not so well characterized as Rattray's *C. centralis*, but must, I think, be reckoned as belonging to that species. Grunow's *C. asteromphalus* also belongs to it, answering as it does quite well to the coarser forms of *C. centralis* (Rattr.) having, as a rule, indistinct marginal apiculi. Grunow expressly mentions (L. 83, p. 27) the convexity, while *C. subbulliens* has a gradually descending marginal zone and therefore is less noticeably convex towards the margin.

Ostenfeld, again, considers *C. oculus iridis* not to be specifically different from *C. radiatus* and therefore does not enter it separately from the Faeroe Islands (L. 116, p. 566).

Other authors on plankton have, in their lists, given very various names from districts where, at any rate, partly the same species are likely to occur, from which it will be seen that there is a considerable difference of opinion with regard to *C. oculus iridis*, *C. asteromphalus, C. radiatus* and *C. concinnus* (*C. centralis* is not generally mentioned).

As the species here mentioned as *C. subbulliens* does not correspond well to *C. oculus iridis*, as one has reason to believe this species was originally looked upon — large, with large central rosette and thus differing from *C. radiatus* — and as there is such a great difference of opinion with regard to the correct meaning of this name, I have thought it best to determine the characteristics of the species, and to use a new name for this form, which is easily recognized. I have not been able, in spite of careful comparisons, to identify it with certainty with any of the species hitherto described. Of names which might be taken into consideration, I will particularly mention *C. heteroporus* and *C. obscurus*. The latter, especially, has many points of similarity with my species, but it does not seem possible, however, from the figures which have been given, to consider them as being identical.

On the other hand, there are certain forms which have been referred to *C. radiatus*, which surely belong to my species. I will for instance, specially mention tab. 60, f. 14 in Schmidt's atlas (*C. obversus* Rattr.) which fairly well answers to many forms which do not specifically differ from my *C. subbulliens*. As I, however, principally base the right of specific rank upon the peculiar convexity of the valve, (in side view), I cannot, for the sake of perfect clearness, very well use Rattray's name, which represents a species, which is but little known.

It is not to be expected that there can be absolute agreement as to the use of Ehrenberg's names *C. oculus iridis, C. centralis, C. radiatus* and many other. But one might perhaps more easily agree as to the meaning of the original name, *C. radiatus,* which is already by most authors used as I do here, excepting that, to some extent, other species are also occasionally included therein. If the name *C. radiatus* Ehrb. be retained, there can hardly be any reason for not attaching to it the meaning above mentioned. It is quite another matter, that there are perhaps those who mean that there still are included in this species others, which in the future will have to be culled out.

Further, there can hardly be different opinions with regard to Rattray's *C. centralis*, unless that some may consider the limits of his species to be too confined, while others may find those of mine to be too wide. At present, it appears by many — as above mentioned — to be looked upon as belonging to *C. concinnus* W. Sm., and I have previously also been of this opinion.

On the other hand, I think that *C. oculus iridis* must be sacrificed (as a species), while *C. subbulliens*, which is certainly

different to both *C. radiatus* and *C. centralis* may be rescued from chaos.

The two prominent authors GRUNOW and RATTRAY, who have given extensive and thorough monographs on the difficult genus *Coscinodiscus*, have in their exceedingly exact description of the differences in the structure of the valve omitted other important distinctive features, especially the shape of the valve in side view. Both of them, especially RATTRAY, indeed often particularly refer to the convexity, but not by any means in every instance, and they often include forms which correspond in structure, but differ considerably in convexity, in the same species. This circumstance, unfortunately, makes GRUNOW's work, which in other respects is so exceedingly thorough, somewhat incomplete and wanting in clearness.

As far as my experience goes, the convexity of the valve is precisely a very certain distinctive feature, and comparatively easy to apply to living species in the plankton. It is even, as far as I can see, the only guiding thread which will serve to lead us out of an otherwise hopeless and interminable maze. Only it must always be remembered that this — just as is the case with regard to structure — is only one distinctive feature, and may lead to the same unnatural piecemealing which the structure has caused; but that both distinctive features in conjunction can give good results.

What I have, in one instance, in the tables called *C. oculus iridis*, is the above mentioned coarser forms of *C. centralis*.

Distribution: Appears to be an arctic and boreal oceanic species, which is rare with us. It is found scattered at several places on our northern coast, especially in deep water.

Appears to extend along the northern, especially the arctic coasts of the Atlantic (Jan Mayen and Spitzbergen, in E. JÖRGENSEN L. 92 named *C. oculus iridis)* and in the districts where the arctic and Atlantic waters mix.

C. nitidus GREG.

GREG. L. 74, p. 499, pl. 10, f. 45. A. SCHM. L. 127, p. 94, pl. 3, f. 32, L. 128, pl. 58, f. 18.

Only found singly in two of the samples, from the Vest Fiord I, 0—50 m., $^{17}/_1$ 1899, and from Senjen $^{21}/_1$, 0—130 m.

Probably only come in by chance and really a bottom form, as it is frequent in bottom samples. (Cfr. under that heading.)

Euodia BAIL. (*Hemidiscus* WALLICH.)

E. gibba BAIL.

BAIL. in PRITCH. L. 123, p. 852, pl. 8, f. 22. *Hemidiscus cuneiformis* WALLICH L. 137, p. 42, pl. 2, f. 3—4.

Very rare with us, in deep water, probably come in with Atlantic water. Hitherto hardly found so far north.

Distribution: Chiefly a subtropical and southern temperate Atlantic form, according to CLEVE (L. 40, p. 330) rare north of 50° northern latitude.

Known both from the European and American side of the Atlantic.

Actinocyclus EHRB.

A. Ehrenbergi RALFS.

Frequent in the plankton.

This species is difficult to distinguish from those closely related to it, and seems to vary considerably.

Distribution: Seems to occur all the year round on the west coast of Norway, and probably also on the north coast, here at any rate in the months January—May. Otherwise widely distributed around the European coasts of the North Atlantic and its arms. Occurs exceptionally right up to Greenland, but is not an arctic form. Seems to have a much wider distribution, judging from the statements in *De Toni*. (L. 50).

A. Ralfsi (W. SM.) RALFS.

This species seems to be much rarer on our coasts, both on the west and north, than the preceding one.

Reference should be made to the chapters on bottom samples, where it occurs somewhat more frequently. It is, however, certainly a genuine plankton form, and not a bottom form.

Distribution: Seems to have a more southerly distribution than the foregoing species. Like the latter, it has also been found at Greenland.

A. subtilis (GREG.) RALFS.

RALFS in PRITCHARD L. 123, p. 835. VAN HEURCK Synopsis (L. 88), p. 216, pl. 124, f. 7. *Eupodiscus subtilis* GREG. L. 74, p. 501, pl. 11, f. 50.

Very rare. Occurred very scarce in the plankton from Kvænangen $^{24}/_1$ 1899, 0—140 m.

Distribution: Known from the coasts of England, Spain, The Mediterranean, The Azores and The Pacific Ocean.

Note. *A. sparsus* (GREG.) RATTR. seems to occur in the plankton from the northern and western coasts of Norway; but as it is difficult to discern between this species and *A. Ehrenbergi*, I have not included it in my tables. Besides, another form occurs, which certainly is specifically different from *A. Ehrenbergi*, and is perhaps the same as the genuine *Eupodiscus crassus* W. SM. Earlier, I took it to be *A. crassus* VII. but have later become somewhat uncertain respecting this species, whose description (by DE TONI and RATTRAY) does not agree well with VAN HEURCK's drawing. In spite of considerable labour, I have not yet been able to come to any definite conclusion, so that I have not tabulated this form either.

For further particulars, reference should be made to the chapter on bottom samples.

A. subocellatus (GRUN.) RATTR.

RATTR. L. 125, p. 145. *Coscinodiscus curvatulus* var. *subocellata* GRUN. L. 83, p. 83, pl. 4, f. 15. *Actinocyclus curvatulus* JAN. in. A. SCHMIDT L. 128, pl. 57, f. 31.

This beautiful diatom is very like *Coscinodiscus curvatulus* and is probably often mistaken for it. Possibly, therefore, it is not quite so rare as it seems to be.

Hitherto only found in a few plankton samples of 1900 (The Skjerstad Fiord, $^2/_4$, IV, V and XII; The Salten Fiord $^5/_4$).

Distribution: Certainly not sufficiently known. Judging from the available accounts, only found fossil and at various places in the Ant-arctic regions.

2. *Melosireæ.*

Thalassiosira Cl.

T. Nordenskiöldi Cl.

Occurs in great quantities in April (from the end of March into the month of May) during the inflow of diatoms, both along the western and northern coasts.

Distribution: Arctic and boreal species, occurs in the winter tolerably far south along the European coasts of the Atlantic and its arms (at least as far as The English Channel). On the west coast of Norway and at the Færöes in quantities in the months of March—May, strangely enough in both localities in August with a less marked secondary maximum.

T. gravida Cl.

(Pl. VI, fig. 4).

Like the preceding species in almost every respect. Occurs often together with it. Endocysts frequent in April.

Distribution: On the whole the same as *T. Nordenskiöldi*, but perhaps less decidedly arctic.

T. hyalina (Grun.) Gran.

(Pl. VI, fig. 5).

Gran L. 65, p. 4. *T. Clevei* Gran L. 64, p. 29, pl. 4, f. 60—62. *C. hyalinus* Grun. L. 48, p. 113, pl. 7, f. 128; L. 83, pl. 3, f. 28. Vix *Coscinodiscus kryophilus* Grun. L. 83, pl. 3, f. 21.

Gran remarks (L. 65 p. 4), that he had at first suspected his new species, *T. Clevei*, to be identical with Grunow's *Coscinodiscus kryophilus*, but that he had not then seen the structure of the valve. Later, by the help of material from the Karajak Fiord (Greenland) he felt sure that the species were identical. As, however, Cleve (cfr. Gran) calls attention to the identity of *C. hyalinus* Grun. in Arctic Diatoms (L. 48) with *T. Clevei*, Gran has altered the name.

That *Thalassiosira Clevei* Gran and *Coscinodiscus hyalinus* Grun. are identical, is quite certain. The only objection, which might be made to this, was, that in Grunow's figure of *Coscinodiscus hyalinus* no asymmetrical marginal apiculus is to be seen. By the kind permission of the Riksmusæum in Stockholm I have been enabled to compare the slides (of mud from the Kara Sea) in which Grunow found *C. hyalinus*, and I can affirm that there is always a well marked asymmetrical marginal apiculus, larger than the others. That this is not to be seen in Grunow's figure is evidently (as is also the reason in the case of *Porosira glacialis* and others) because it may so easily be mistaken for a foreign body (dirt) which is only there as a matter of chance. (The preparations referred to were, in fact, rather dirty.)

The specimens of *C. hyalinus* from the Kara Sea altogether plainly showed that this species is identical with the one which occurs on the northern coasts of Norway in the Spring.

On the contrary, it seems to me to be open to considerable doubt as to whether *C. hyalinus* Grun. and *C. kryophilus* Grun. are identical. It is quite strange that Grunow, in an exceedingly careful and exact monograph on the family in question, should illustrate and mention these species as different ones without hinting at any connection between them. Certainly he considered the asymmetrical apiculus to be characteristic of the one species only, *C. kryophilus;* but there is, nevertheless, a great difference in the figures, both with regard to structure and the marginal apiculi. These latter are particularly small in *C. kryophilus*, while in *C. hyalinus* they are very plain and comparatively large. The structure too of *C. kryophilus* is considerably coarser than that of *C. hyalinus*, even if one does not put too much weight on the fasciculi, which in the figure of *C. kryophilus* are very clear and regular, while in *C. hyalinus* they are indefinite.

In material from Cape Wankarema (Vega Expedition) — which material was also kindly lent to me by the Riksmusæum, Stockholm — I really found a Coscinodiscus which seemed in every respect to correspond to *C. kryophilus*. It had just that characteristic form of the asymmetrical apiculus, which is figured by Grunow, and also the very small marginal apiculi, which are much less conspicuous in comparison to the asymmetrical apiculus than is the case in *C. hyalinus*. (Pl. VI, f. 6, a, b.)

Distribution: On the arctic coasts of Greenland, Franz Joseph's Land and Jan Mayen. On the northern coasts of Norway, here only observed during the time of the inflow of diatoms, when the species occurs in large quantities. Towards the south, it has been found at Ona in Romsdal (in the Spring, not rare; cfr. Gran L. 70, p. 170).

Seems not to occur with us in the months of June—February. If it does not then — as Gran supposes — „over-summer" at the bottom by the help of resting spores, it must — if it is actually found wanting in the other months of the year than just the Spring ones — every year be brought in from outside.

T. decipiens Grun.

(Pl. VI, fig. 3).

Coscinodiscus decipiens Grun. in Van Heurck L. 88, pl. 91, f. 10 (from Lamlash Bay). A. Schmidt L. 126, pl. 3, f. 38. *Thalassiosira gelatinosa* Hensen L. 87, p. 87. *Orthosira angulata* Greg. L. 74, p. 498, pl. 10, f. 43 and 43 b.

As it seems to me beyond doubt that Grunow's *Cosc. decipiens* is the same species as Hensen's *Thalassiosira gelatinosa* (as this species is understood by Cleve and others), I have found it necessary to alter the name, the more so as Hensen's description is very incomplete.

I have not had any opportunity of making comparisons with Grunow's work (Algen und Diatomaceen aus dem Kaspischen Meere in Dr. O. Schneider: — Naturwiss. Beitr. z. Kenntniss d. Kaukasusländer, Dresden 1878); but as Grunow himself figures a specimen from Lamlash Bay in Van Heurck's Synopsis, I have thought that I could keep to this figure, which undoubtedly represents the same species which Cleve, and others after him, has called *T. gelatinosa* Hens. Grunow remarks that the species is identical with *Orthosira angulata* Greg.

Gregory's description (L. 74, p. 498) does very well too for our species, less the drawing. It is interesting that Gregory has found the species occurring in chains. His opinion, viz. that these chains are constructed similarly to those of *Melosira* (where the links touch each other), may no doubt be accounted for by the fact that the long marginal apiculi in a side view may so easily produce the same image as the cells.

In the plankton from the northern coasts of Norway, this species appears to vary considerably. Two principal series of forms occur, the one with numerous marginal spines and a not very plain excentric structure, but plain fasciculi; the other with fewer mar-

ginal spines and plainer excentric secondary curves. The figures referred to above belong to the latter form. There appears, however, to be so much variety, both in the number of the spines and their distance from each other, and in the number of the fasciculi, that it does not seem adviseable to look upon the two series of forms as being specifically different.

As the species does not always appear to be rightly understood, I have added a few remarks on its structure.

Around a central areole there are, as in *C. excentricus*, 7 areoles forming, in conjunction with the central areole, an indistinct central rosette. From here the areoles decrease in size quickly and evenly right out to the margin. The secondary curves near the margin are nearly straight, often nearly to $^2/_5$ of the radius reckoned from the margin inwards, but further in, towards the centre, decidedly concave outwards, as in *C. excentricus*. The valve is decidedly convex on account of the high and abrupt marginal zone, and is thus easily discerned from *C. excentricus*, which is nearly quite flat. Besides *Thalassiosira decipiens* always has the very long, bent marginal spines. An odd, asymmetrical, spine is always present.

In side view the chains may very easily be taken for *T. Nordenskiöldi*, whose structure, however, is altogether different.

Only observed during the inflow of diatoms, at which time it was abundant and frequently (especially in 1900) in large quantities.

Distribution: Seems to be the same as that of *Thalassiosira Nordenskiöldi* and *T. gravida*, and is often met with in their company. Yet, the secondary maximum in August is wanting (on the west coast of Norway and the Faeröes), and the species is, on the whole, very rare except at the time of the Spring inflow.

Coscinosira Gran.

C. polychorda (Gran) Gran.

As I have mentioned in an earlier paper, (L. 92, p. 24), this species may easily be confused with *Coscinodiscus lineatus*, as the characteristic transverse processus are often difficult to discover, and it seems possible that thy may be altogether wanting. The most frequent form with 6 fasciculi corresponding to 6 transverse processus will, thus, on the whole, have the same structure as *Cosc. lineatus*, only much finer. The specimens which I have tabulated as *Cosc. lineatus var.* from a few places, are perhaps such forms of *Coscinosira polychorda* where the transverse processus are wanting.

Marginal apiculi, granules and various other processus on the valves of diatoms seem to be rather inconstant, or at any rate very varying, which probably is owing to their being more or less incompletely silicated.

Very rare, except at the time of the inflow of diatoms, when it is abundant.

Distribution: On the whole, the same as *Thalassiosira Nordenskiöldi* and *T. gravida.* It appears to occur all the year round on the west coast of Norway, where it has, at any rate, been found in most months; but it is common only during the inflow in the Spring.

Porosira n. gen.

Structure of the valve is in the only known species very fine, in other respects as *Podosira hormoïdes*. Over the whole surface, thickest along the margin, scattered pores which probably are the perforations of more or less plain short, hollow spines. Such are seen near the margin after destruction of the organic matter by burning.

Inside the margin at one spot on the surface, a large, strong, odd (asymmetrical) spine. The connective zone is apparently formed of numerous rings, which, owing to their delicacy, are rather indistinct.

Forms chains, of two or a few links, in which the latter are joined together by a short, and very thick, central mucilaginous band, in which one may with some difficulty discover fine threads. The band seems almost to be structureless and is as good as invisible in water, but is easily seen on colouring with various dyes e. g. methylene blue and gentian violet.

Chromatophores, on the whole, the same as in Coscinodiscus, polygonally roundish discs scattered along the valves and the connective zone.

It seems to me to be somewhat unnatural, like Gran, to refer the following species to the genus *Lauderia*. I think it would be best to limit that genus to those species only which form stiff chains of links which touch each other). On the other hand, the difference between this species and *Thalassiosira* is so great that it should scarcely be considered as belonging to this genus either, notwithstanding that the chains, generally speaking, are similarly formed. There is too, according to my opinion, another important difference in the structure of these genera, which I hope to be able to explain more fully on a later occasion.

The genus *Podosira* forms stipitated chains (of 2 or a few individuals). Perhaps it will, however, prove not to be possible to carry out a systematic classification based upon such principles, although it would seem to be an important consideration, in a natural system, whether a chain colony is swimming freely about (plantonic) or is fettered. On the other hand it may perhaps be found that several species of Coscinodiscus with scattered dots on the surface will find a more natural place in my proposed genus *Porosira*.

P. glacialis (Grun.)

(Pl. VI, fig. 7).

Podosira hormoides var. *glacialis* Grun. L. 83, p. 56, pl. 5, f. 32. *P. glacialis* (Grun.) Cl. L. 27, p. 24. *Lauderia glacialis* (Grun.) Gran L. 68, p. 111.

Out of the pores of the valve extend fine threads, which are only seen with difficulty, in a very thick, short mucilaginous cylinder, which connects both valves. Probably similar threads extend without this cylinder.

There are also near the margin, long fine, mucilaginous threads which extend obliquely outwards and downwards, and probably serve as a floating apparatus. Precisely similar threads are found in Thalassiosira gravida, whose structure is remarkably like that of the above species.

Very scarce except during the inflow of diatoms, but then very frequent and often in great quantities, especially in 1899.

Distribution: Yet unsufficiently known, but probably, on the whole, the same as *Thalassiosira Nordenskiöldi*. Also found in the Kara Sea. Numerous in the year 1900 during the inflow of diatoms in the Spring on the west coast of Norway.

Sceletonema *costatum* (Greg.) Cl.

Distribution: Very frequent on the west coast of Norway, often in large quantities. Occurs all the year round, but varies very much in quantity. On the north coast April—May; here too there are very great variations in quantity. Also more or less frequent on the northern European coasts of the Atlantic and its arms. Known too from a few places on the tropical coasts (Bengal, Java, Hongkong, The West Indies) and from Japan.

Paralia *sulcata* (Ehrb.) Cl.

Hardly a true plankton form, at any rate not with us. Is very frequent in bottom samples (cfr. the corresponding chapter) from Nordland and Finmarken. The few specimens which have been found in plankton samples, especially from deep water near the bottom, have probably come there quite by accident. The numerous valves which are found in bottom samples, cannot be considered to come from plankton, for then one would expect to find the species, at any rate occasionally, numerous in plankton samples, which is, however, as far as my experience goes, never the case, at least with us. Nothing is proved either by the presence of a few solitary individuals in samples taken far from the bottom, as such individuals may have been brought there with algæ which have been torn away or — when they are found in diatom slides — may have been swallowed by crustacea or similar small animals.

Distribution: Frequent on the northern coasts of the Atlantic (on the American side from the coast of Central America) right up to Greenland and Franz Joseph's Land. Mentioned as occurring (February 1903) now and then in abundance in surface samples from the English Channel (L. 18).

Hyalodiscus Ehrb.

H. scoticus (Kütz.) Grun.

No true plankton form. Frequent in bottom samples (cfr. the corresponding chapter).

H. subtilis Bail.

Bail. L. 8, p. 10. f. 12.

In a plankton sample from Malangen $^{29}/_{1}$ 1899, 0—300 m., a few single specimens were found which seemed to belong to this species.

Hardly any true plankton form.

H. stelliger Bail.

Doubtful as a true plankton form. Neither is it frequent in bottom samples. Perhaps come in with algæ.

Distribution: The northern European coasts of the Atlantic and its arms.

On the west coast of Norway found all the year round in plankton, but always in small quantities. Mentioned from the English Channel in surface samples, occasionally numerous (especially in February 1903), often together with *Paralia sulcata.*

3. *Eupodisceæ.*

Roperia Grun. in Van Heurck.
(L. 88, pl. 118).

R. tessellata (Rop.) Grun.

Grun. l. c. pl. 118, f. 6—7. *Eupodiscus tessellatus* Rop. L. 126, p. 19, pl. 3, f. 1 a, b. *Actinocyclus tessellatus* Ralfs in Pritch. (L. 123) p. 835.

Peculiar structure (cfr. Van Heurck's Synopsis). It seems, however, that it may well be included, at any rate as a subgenus, in the genus *Actinocyclus.*

This beautiful species occurs only singly and rarely in the plankton, in deep water samples in 1899: — $^{18}/_{1}$ The Vest Fiord I, 0—180 m.; $^{21}/_{1}$ Senjen, 0—130 m.; $^{21}/_{2}$ Henningsvær, 0—250 m.

Distribution: Occurs, according to Cleve, on the coasts of Scotland. Scarcely a litoral, but certainly a true plankton form. Also known from the coasts of France and England. It has most likely been overlooked, and is probably more frequent than the few places mentioned would indicate. Also occurs on the west coast of Norway, but seldom (Feb. 1899). I have also seen it in oceanic plankton samples outside the north west coast of Norway (S/S Michael Sars 1901).

Judging from its occurrence with us, it gives the impression of being a temperate, Atlantic, oceanic species.

Auliscus Ehrb.
L. 54, p. 270.

A. sculptus (W. Sm.) Ralfs.

Ralfs in Pritch. (L. 123), p. 845, pl. 6, f. 3. Van Heurck L. 88, pl. 117, f. 1—2. *Eupodiscus sculptus* W. Sm. L. 134, I, p. 25, pl. 4, f. 39.

No true plankton form. Frequent in bottom samples, both from the northern and western coasts of Norway. (Cfr. the corresponding chapter.)

4. *Asterolampreæ.*

Actinoptychus undulatus (Bail.?) Ralfs.

I am not sure if this species really is a true plankton form. It occurs especially in deep water samples and always very scarcely. It is not numerous in bottom samples either.

Distribution: Has a wide distribution on the northern European coasts of the Atlantic and its arms, and is found right up to Greenland. Is not considered by Cleve and Ostenfeld to be a genuine plankton form.

Is mentioned (L. 18, IV) as occasionally frequent in surface samples from the English Channel (Feb. 1903). In the same samples, other doubtful plankton forms, such as *Paralia sulcata* and *Hyalodiscus stelliger*, also occur more or less frequent.

Asteromphalus *heptactis* (Bréb.) Ralfs.

Very rare: January 1899, especially in deep water samples.

Distribution: With us a southern, oceanic species, which is

very rare both on the west and north coast, and especially (only?) occurs in the winter months. According to Cleve (L. 40, p. 284) widely distributed in the temperate part of the Atlantic.

5. *Biddulphieæ.*

Biddulphia Gray.

B. aurita (Lyngb.) Bréb.

Occurs very rarely in January and February, but much more frequently during the period of the diatom inflow, and then occasionally in larger quantities.

Distribution: On the northern coasts of the Atlantic and its arms, right up to the arctic regions. (Greenland). Arctic and boreal species, on the west coast of Norway and off the Faerŏes only found in the months of Spring.

B. mobiliensis Bail.

Very rare and only singly.

Distribution: Appears to be a southern form, which is not found all the year round on the coasts of Norway. On the west coast, it is most frequent in February and November. According to Cleve, in large quantities on the coast of the British Isles.

February 1903 in abundance in the English Channel (L. 18, IV).

Eucampia ***groenlandica*** Cl.
(Pl. VI, fig. 8).

Only found twice: Brettesnes, $^4/_4$ 1899, 0—3 m., Ingŏhavet $^{24}/_4$ 1890, 0—300 m.

Distribution: Arctic coast: Baffins Bay, Davis Strait, Greenland. Also found, single specimens, on the coasts of Bohuslän (Sweden) and Scotland.

6. *Chætocereæ.*

Detonula *confervacea* (Cl.) Gran.

Lauderia confervacea Cl. L. 26, p. 11, pl. II, f. 21. *Detonula confervacea* Gran L. 68, p. 113.

Specimens, which seemed to belong to this species, were seen singly in one of the samples: — Fŏlstad $^4/_4$ 1899, in a surface sample (0—3 m.).

Distribution: Baffin's Bay. A closely related species, *D. cystifera* Gran l. c. p. 113, pl. 9, f. 15—20, has been found in the Lim Fiord in Denmark, in the winter.

Bacterosira Gran.
L. 68, p. 114.

B. fragilis (Gran) Gran l. c.

Lauderia fragilis Gran L. 65, p. 115, pl. 1, f. 12—14.

Occurs only during the inflow of diatoms in the spring months. Very frequent from the beginning of April, often in great quantities.

Distribution: Does not occur on the west coast of Norway. Decidedly arctic species. Found earlier by Gran on the coast of Nordland and Finmark (April 1901.) Also known from Greenland, the sea west of Novaja Semlja (S/S Heimdal, May 1900, cfr. Gran L. 70, p. 170), several places on the north and west coasts of Iceland and Greenland (May and June 1898, cfr. Cleve L. 40, p. 331) and right up to Spitzbergen and the sea between Spitzbergen and Iceland (May and July 1899; cfr. Cl. l. c.)

Ditylium ***Brightwelli*** (West.) Grun.

Rare and scarce.

Distribution: According to Cleve (L. 40, p. 325) very frequent in the English Channel, the North Sea and Skagerack, only scarce in the Atlantic. Can hardly be considered as native on the west coast of Norway, but is found here in small numbers in most months of the year. Numerous in February 1903 (scarce in May of the same year, L. 18, IV). Probably comes to us from the more southern coasts.

Rhizosolenia Ehrb.

R. alata Brightw.

Very rare and only scarce.

Distribution: Widely distributed in the southern and northern temperate districts of the Atlantic. (Cf. Cleve L. 40, p. 337). In the English Channel occasionally frequent in February 1903 (L. 18, IV). Hardly to be considered native on the west coast of Norway, but found in small numbers in nearly all the months of the year. Comes to us as a southern oceanic form. Also known from Mediterranean, the Indian and the Pacific Ocean.

R. styliformis Brightw.

Only once found: — Skroven $^4/_3$ 1899, in a deep water sample, scarce.

Distribution: Widely distributed from the warmer districts of the Atlantic right up to Greenland and Spitzbergen. On the west coast of Norway most frequent in the summer months. The same at the Faeroe Islands. Comes to us as a southern oceanic form. Also known from the Mediterranean, the Indian Ocean and the Pacific Ocean.

R. Shrubsoli Cl.

Only found scarce in two samples: — $^{12}/_4$ 1899 Malangen 0—100 m., and $^{21}/_3$ 1900 Balstad, 0—50 m.

Distribution: Distributed over the temperate European coasts of the Atlantic. Occurs on the west coast of Norway and at the Faeroe Islands all the year round, most frequent in the summer months. According to Gran (L. 70, p. 173) at Ona (Romsdalen), occasionally, from May to October. It would thus appear to be stationary on the west coast of Norway, but not on the north coast. Quite exceptionally found northwards right up to Greenland. Also known from the Mediterranean, the Indian Ocean and Japan (cf. Cleve L. 40, p. 348).

R. semispina Hens.

Very rare and only singly.

Distribution: Occurs as an oceanic form in large numbers in the arctic waters and in the boundaries of the arctic and Atlantic waters. Not frequent on the coast of the Faeroe Isles, nor on the west coast of Norway, where it is, nevertheless, found in most

months, most frequent in November (1898). According to Cleve, also known from Hudson's Bay.

R. setigera Brightw.

Only once found: — $^{14}/_{4}$ 1899 Malangen, in a deep water sample.

Distribution: Neritic species, scarcely to be considered native to the Norwegian coasts. Known from the coasts of France, England and Scotland, as well as from the Skagerack and the west coast of Norway. Gives the impression of being brought to the latter from the southern coasts in the autumn, but also occurs in the winter and spring months, but always in small numbers. Has therefore probably also a (smaller) northern area of distribution. (Is reckoned by Cleve to be a southern and northern neritic species).

Corethron *hystrix* Hens.

Very rare and only scarce.

Distribution: Comes to us as a southern oceanic form. On the west coast of Norway also very rare (1898). Rare too near the Faeroe Isles. Distributed in the Northern temperate Atlantic up to Iceland and East Greenland.

Chætoceros Ehrb.

C. borealis Bail.

Occurs in numerous samples, but always in small numbers.

Distribution: Arctic and northern temperate, oceanic form, which often occurs in very large numbers in arctic waters and in the boundaries between these and the Atlantic. On the west coast of Norway, 1898, more or less frequent in most months, especially in May—July. A similar state of things was found at the Faeroe Isles.

C. densus Cl.

Does not seem to be frequent. Is, however, perhaps often mistaken for other forms.

Distribution: Appears to be a southern form.

C. densus Cl. var. ***rudis*** Cl.

The form entered in the tables for 1900 under this name is uncertain. Although in side view as well as by its unusually coarse and coarsely dentate awns recalling the illustration of *Chaetoceros borealis* var. *rudis* in Cleve's Phytoplankton (L. 27) pl. 1, f. 5, it differs in some other points; neither do I know the shape of the terminal awns nor their direction in Cleve's species.

It is, at any rate, very improbable that my species is the same as *C. coarctatus* Laud., which Cleve (L. 40, p. 308) mentions as being the right name for the form which he previously called *C. borealis* var. *rudis*.

C. danicus Cl.

Very rare and only scarce. Only found in a few samples: $^{4}/_{4}$ 1899, Helle, 0—3 m., $^{20}/_{3}$ 1900, Höla, 0—50 m. and the Salten Fiord, $^{5}/_{4}$ 1900.

Distribution: The northern European coasts of the Atlantic and its arms as far as the Baltic. On the west coast of Norway it is found most months, but most frequently in the summer.

C. criophilus Castr.

Cfr. E. Jørgensen L. 92.

Only once found: $^{24}/_{4}$ 1899, in the sea off Ingö.

Distribution: Appears to be a decidedly arctic species, which often occurs in very large quantities in the arctic waters and in their boundary towards the Atlantic. Its distribution is, however, not sufficiently known, as it has been confused with the following species.

C. convolutus Castr.

Cfr. E. Jørgensen L. 92.

Frequent during the inflow of diatoms in spring, often rather numerous. Otherwise scarce.

Distribution: Appears to be an arctic and boreal species, which often occurs in large quantities in the arctic waters and their boundary towards the Atlantic (Jan Mayen 1897). On the west coast of Norway found all the year round, but always in small numbers. It may be possible that this species is neritic rather than oceanic. Frequent in May 1903 in the English Channel (L. 18, IV).

C. atlanticus Cl.

Frequent, but only as an exception somewhat numerous, generally only scarce.

Distribution: Arctic and boreal oceanic form, often occurring in very large quantities in the arctic waters and their boundary towards the Atlantic. (Cfr. E. Jørgensen L. 92). On the west coast of Norway found in most months, but, as a rule, scarce. Common off the Faeröes in spring.

C. decipiens Cl.

Frequent during the diatom inflow in spring, otherwise rare and scarce. Decidedly more frequent in the samples of 1900 than in those of 1899.

Distribution: Arctic and boreal oceanic form which seems to bear the change from the arctic to the Atlantic waters particularly well. Often occurs in abundance in the boundary waters. On the west coast of Norway, rather common, reaching its maximum in April (1898). This also the case at the Faeroe Islands. Also very abundant on the west coast of Norway in the months July—September (1898).

C. teres Cl.

Frequent in the samples, but always in small numbers.

Distribution: Arctic (oceanic?) and boreal form, which only as an exception appears to be found more numerous. On the west coast of Norway very scarce, though found in most months. Near the Faeroe Islands frequent in the months March—June, at other times rare. At Ona (cfr. Gran L. 70, p. 178) from March to July, most frequent in April.

My opinion is that this is an oceanic species rather than a neritic one, and is hardly native on our coasts. (Has been repeatedly found with endocysts, therefore, according to Gran, neritic, but a form which may often drift far out into the open sea).

C. contortus Schütt.

Generally speaking rare and scarce, only occasionally numerous during the diatom inflow in the spring of 1899.

Distribution: More or less frequent on the northern European coasts of the Atlantic and its arms. On the west coast of Norway frequent, often numerous; most likely here native.

C. similis Cl.

Very scarce (in three samples) and only singly.

Distribution: On the west coast of Norway somewhat frequent, especially at the beginning of the diatom inflow (March 1898). Does not occur in all the months of the year here neither. Off the Faeroe Islands not rare in the months of Aug.—September 1902, otherwise only once in March 1901 (cfr. Ostenfeld L. 116, p. 573). According to Gran L. 70, p. 179 on the north east coast of Iceland, scarce. Otherwise found more or less scarce on the coasts of the North Sea and Skagerack.

According to Gran, this species is neritic (endocysts being found). My opinion is that it is probably neritic, but not likely to prove native with us.

C. constrictus Gran.

Very rare and scarce, only found twice: $^{24}/_4$ 1899, in the sea off Ingö, 0—300 m.; $^1/_5$ 1899, Vardö, 0—200 m.

Distribution: Occurs on the northern coasts of the Atlantic on the American side, off Iceland, the Faeroe Islands, Great Britain and the coasts of the North Sea. On the west coast of Norway found in 1898 nearly all the year through, most numerous in April and November. Does not appear to be native on the northern coasts of Norway.

C. laciniosus Schütt.

On the whole rather rare and scarce, although occasionally more frequent in the month of May 1899.

Distribution: Northern temperate coast form. On the west coast of Norway frequent; occurs during most months, but seldom numerous. Rare round the Faeroe Islands. At Ona in Romsdalen March—October, reaching its maximum in May. (Cfr. Gran L. 70, p. 178).

C. brevis Schütt.

Cfr. E. Jørgensen L. 91, p. 12 and Ostenfeld L. 114, p. 295.

Very rare and scarce, only found in two samples: $^4/_4$ 1899, Helle, 0—3 m.; $^6/_4$ 1900, the Folden Fiord I, 0—100 m.

Distribution: Not sufficiently known, as this species has been confused with the foregoing one. Rare on the west coast of Norway, and generally found singly; noticed in the months of August, November and December. In the English Channel in May 1903, scarce. Does not appear to be native on the northern coasts of Norway.

C. Schüttii Cl.

Very rare and scarce, only found in two samples: Lyngen, $^{27}/_1$ 1899, 0—50 m.; Malangen $^{29}/_1$ 1899, 0—300 m.

Distribution: Southern form, distributed along the coasts of the North Sea. Rather rare on the west coast of Norway, (1898: August—September, November—December). Often found in the open sea. Round the Faeroe Islands, both in an easternly and westernly direction, at considerable distance out, in quantities in May 1903 (L. 18, IV). Seems to come to us as a southern oceanic form.

C. Willei Gran.

Rare and scarce, only found in a few samples. Most likely the same form which is mentioned by Ostenfeld from the Faeroe Islands (L. 116, p. 573) as an intermediate form between *C. Schüttii* and *C. Willei.*

Distribution: Frequent on the west coast of Norway and probably native here. Distributed along the coasts of the North Sea, and extends farther northwards than the foregoing species. Does not, however, appear to be native to the northern coasts of Norway.

C. diadema (Ehrb.) Gran.

Common and in great quantities during the diatom inflow in spring; at other times rare and singly. Often found with endocysts.

It is possible that there are, in this species, still included specifically different forms.

Distribution: Arctic and boreal coast form. Rare round the Faeroe Islands. Found in most months of the year, but as a rule not numerous, on the west coast of Norway. Very frequent at Ona, in Romsdalen, in March—April, less so in June—July. (Gran L. 70, p. 179).

C. furcellatus Bail.

In large quantities during the diatom inflow in the spring of 1899, less abundant in the samples of 1900. May easily be confused with other species, when its characteristic endocysts are wanting. In 1900 they were mostly absent.

Distribution: Arctic coast form, widely distributed from the coasts of Iceland right up to the arctic regions, both on the American and European side. Wanting on the west coast of Norway and round the Faeroe Islands. Frequent in March—April at Ona (Gran L. 70, p. 180).

C. curvisetus Cl.

Very rare and scarce, only found in two of the samples, Helligvær, $^{12}/_1$ 1899, 0—50 m., and Balstad, $^{21}/_3$ 1900, 0—50 m.

Distribution: Southern coast form from the temperate, European coasts of the Atlantic, northwards to Skagerack, the North Sea and the west coast of Norway. On the latter coast, frequent in nearly every month of 1898, most numerous during the summer. Ona: March, July—August, occasionally (Gran L. 70, p. 179).

Very seldom noticed as far north as Spitzbergen. Not mentioned from the Faeroe Islands.

C. debilis Cl.

Frequent during the diatom inflow in spring, often in large quantities; at other times very scarce.

Distribution: Distributed along the northern European coasts of the Atlantic, the North Sea and Skagerack. On the west coast of Norway and round the Faeroe Islands very frequent, with maximum twice a year, in the spring months and in August. Also found near Greenland.

C. socialis Laud.

In large quantities during the diatom inflow in spring. Endocysts very frequent.

Distribution: Arctic coast form. Occurs in quantities also on the west coast of Norway during the diatom inflow in spring. Only occasionally round the Faeroe Islands.

I b. Pennatæ.

7. *Synedreæ.*

Thalassiothrix Cl. et Grun.

T. longissima Cl. et Grun.

In 1899 rare and scarce, in 1900 not observed.

Distribution: Oceanic species, distributed over the northern part of the Atlantic from the American to the European side, right up to Spitzbergen. On the west coast of Norway in 1898 found during most months of the year, but always scarce. Very rare round the Faeroe Islands.

T. nitzschioides Grun.
(Pl. VI, fig. 11).

Grun. in VH. Syn. (L. 88), pl. 43, f. 7—10.

(In the tables *T. Frauenfeldii* and *T. Fr.* var. *nitzschioides*).

This species is certainly the same as the one which, in nearly all plankton tables, is called *T. Frauenfeldii*. Strangely enough, Cleve refers (L. 40, p. 356 & 357) to VH. Synopsis pl. 37, f. 11—12 and, for „the variety" *javanica* Grun., f. 13. The species which corresponds to figures 11 and 12, and which I know from the Indian Ocean, is, however, very different from the one which is so frequently seen in the coast plankton in our latitudes. The „variety" *javanica* Grun. does correspond better with regard to the closeness of the puncta, but, in other respects, differs so much that it can hardly be considered to be the same as our common plankton species. On the other hand, it is also in structure so different from what is taken to be the main species that it cannot be united with it unless, (as perhaps is the case, although I have never seen any mention of such) there are a number of intermediate forms.

But our plankton species, as far as I can see, corresponds in every respect to *Thalassiothrix? nitzschioides* Grun. It is true that this species does not answer well to the characteristics of the genus *Thalassiothrix*, but is yet so different in important points from the genus Synedra that I think it should better be referred as a subgenus *Thalassionema* (Grun.) to *Thalassiothrix* rather than be retained in the genus Synedra.

I have earlier thought, from the description given by *De Toni* of the structure of these forms (L. 50, p. 672—673), that all three (*T. Frauenfeldii, T. javanica* and *T. nitzschioides*) should be considered as one species (cfr. E. Jørgensen L. 91, p. 22), but have since not found, after my own experience, any definite reason for so doing.

More or less frequent, especially during the diatom inflow in the spring of 1900, but never noticed in such large quantities as in more southerly samples.

Distribution: This species is certainly neritic, but the genuine *T. Frauenfeldii* is probably oceanic. Is widely distributed along the coasts of the northern Atlantic and its arms, northwards as far as Greenland. On the west coast of Norway common, in large quantities in the spring.

Fragilaria Lyngb.

F. oceanica Cl.

Cl. L. 22, p. 22, pl. 4, f. 25 a, b. Gran L. 65, p. 8, pl. 1, f. 6—9.

In large quantities during the diatom inflow, at other times absent. Strange to say it appears all at once in large quantities.

Distribution: Arctic coast form. According to Cleve also found in Hudson's Bay. Is not found so far south as Bergen, on the west coast of Norway. At Ona frequent in March—April, according to Gran (L. 70, p. 180).

F. cylindrus Grun.
(Plate VI, fig. 9).

Grun. L. 83, p. 55, pl. 2, f. 13. Gran L. 65, p. 8, pl. 1, f. 4—5.

Occurs together with the preceding species in large quantities in spring.

Distribution: On the coast of North Siberia, Frantz Joseph's Land and Greenland; in quantities in May in Davis Strait (Cleve L. 26). Probably a neritic arctic species. Not mentioned before from Norway. In the Barents Sea, 71° 48′ n. lat., 49° 38′ e. long. $^{31}/_{5}$ 1900, numerous together with the preceding species.

F. islandica Grun.
(Pl. VI, fig. 10).

Grunow in VH. L. 88, pl. 45, f. 37.

In some few samples from 1900 during the diatom inflow in spring a species was observed, which I think is identical with the one above mentioned. It occurred sparingly, but in rather long chains. I have not, however, succeeded in seing it in valvar view.

Distribution: Jan Mayen (l. c.) By Cleve also once observed numerous in the North Sea (L. 27, p. 3), together with northern neritic species.

8. *Plagiogrammeæ.*

Glyphodesmis ***Williamsonii*** (W. Sm.) Grun.

Hardly a genuine plancton form. Here, as on the west coast of Norway, probably brought in by (or torn off from) species of fixed algæ (sea—weed).

9. *Tabellarieæ.*

Grammatophora Ehrb.

G. islandica Ehrb. and **G. oceanica** Ehrb.

Not genuine plankton forms, only torn off from algae, or carried on with them.

Rhabdonema Kütz.

***R. minutum* Kütz., *R. arcuatum* (Lyngb.) Kütz. and *R. adriaticum* Kütz.**

Not genuine plankton forms, most likely by accident brought along from fixed algae.

Striatella *unipunctata* (Lyngb.) Ag.

Very rare and scarce. The Vest Fiord $^1/_2$ 1899, 0—200 m., the Ögs Fiord II, $^{14}/_3$ 1899, 0—200 m., and the Skjerstad Fiord V, $^3/_4$ 1900, 0—420 m.

Hardly a genuine plankton form, by chance brought in from fixed algae.

Distribution: Widely distributed along the temperate coasts of the Atlantic. Also mentioned from Finmark, where it, however, to judge from the bottom samples, appears to be rare.

10. *Nitzschieæ.*

Bacillaria *socialis* Greg.

Greg. L. 75, p. 80, pl. 1, f. 45. VH. Synopsis (L. 88), pl. 61, f. 8.

(Wrongly entered in the tables as *B. paradoxa).*

Not a genuine plankton form. Only very sparsely and quite exceptionally noticed in the plankton. Frequent in the bottom samples.

Distribution: The coasts of the Atlantic from Portugal to the arctic regions (Sea of Kara). Also mentioned from the Baltic and the Antilles.

Nitzschia Hass.

***N. seriata* Cl. (including *N. fraudulenta* Cl.)**

Only found during the inflow of diatoms in spring, then almost always frequent, and often numerous.

Distribution: Arctic and boreal species. It seems to be a neritic species, which may perhaps be native to our west coast where it is found more or less abundantly during most months (of 1898), often in quantities, most numerous in May—June. Off the Faeroe Islands generally very sparsely, but numerous in June 1898. Also known from Greenland, Spitzbergen and the Barents Sea (S/S Heimdal 1900, $^{21}/_5$, 71° 48′ n., 49° 38′ east, sparsely). Cfr. Cleve L. 40, p. 335, where he mentions the species as being specially distributed between Scotland, Iceland and Greenland. He also (l. c.) mentions that *var. fraudulenta* is known from the Mediterranean. It is therefore probable that there are two species; the one, *N. fraudulenta* Cl. having a southern distribution and being probably oceanic, while the other is neritic and arctic.

***N. delicatissima* Cl.**

Cl. L. 27, p. 24, pl. 2, f. 22.

This species is so small, more particularly so narrow, that it must be supposed as a rule to go through the net. In the plankton material at my disposal it has certainly in the majority of cases been retained by the colonies of *Phæocystis.*

Like the preceding, only found during the inflow of diatoms in spring, then frequent, and in all probability much more so than would appear from the tables.

Distribution: Probably, like the preceding species, really an arctic, neritic species, which, however, seems to thrive in the water mixed with the warmer Atlantic. Also, like the preceding species, found off the Faeroe Islands. Known too from Spitzbergen and Skagerack where it occurs in winter. At Ona (cfr. Gran L. 70, p. 181) frequent in June—July 190 .

***N. hybrida* Grun.**
(Pl. VI, fig. 12).

Cl. and Grun. L. 48, p. 79, pl. 5, f. 95. VH. Synopsis (L. 88) pl. 60, f. 4—5.

I have included, under this heading, a number of forms which frequently occurred during the inflow of diatoms in the spring of 1899 and 1900, although generally only in small numbers. They are not in every instance entered in the tables, and are considerably more frequent than would appear from them. Seems to be a genuine plankton form. I have illustrated some of these forms (Pl. VI, fig. 12). Figure 12 a represents those which are most frequent, but they are most often less distinctly constricted in the middle, often of an even breadth.

Striæ I have only seen on the one illustrated by fig. 12 e (about 27 on 10 μ) which differs considerably from the ordinary form, also in the number of puncta on its keel (13 on 10 μ).

The closely allied species *N. (hybrida var.?) pellucida* Grun. has the puncta on the keel somewhat closer (13—14 on 10 μ) but in other respects it answers better to the forms which I have observed.

Grunow mentions (l. c.) that there are a number of intermediate forms, which it is difficult to define, between *N. bilobata* and *N. hybrida.* All my forms have the keel puncta more widely separated in the middle; they are often comparatively long and there is a decided trace of a central nodule. The keel appears to be very eccentric — I have, however, only in a couple of instances seen the species in valvar view, cfr. fig. 12 d — so that there seems to be a connection with the forms which are related to *N. dubia* W. Sm.

Seems to be a genuine plankton form. It is (with us) only slightly siliceous and often occurs in pairs, quite rarely also in short chains of several links.

Distribution: Arctic and boreal coast form. Known from Greenland, Spitzbergen, the Barents Sea, (S/S Heimdal 1900, $^{31}/_5$, 71° 48′ n., 49° 38 east, in small numbers, the same form as with us) and the Kara Sea. Cfr. De Toni (L. 50, p. 513) who mentions it as occurring also on the coasts of Great Britain.

***N. bilobata* W. Sm.**

W. Sm. L. 134, p. 42. pl. 15, f. 113. VH. Synopsis p. 175, pl. 60, f. 1.

Occurs very seldom and only singly. Hardly a true plankton form.

Distribution: Widely distributed on the temperate European coasts of the Atlantic.

***N. frigida* Grun.**

Cl. and Grun. L. 48, p. 94, pl. 5, f. 101.

Rather rare and always in small numbers, there is a form

which corresponds to the illustration mentioned where there is given a front view of this species. Besides typical forms, others also occur which are hardly any broader in the middle.

I have not seen this species in valvar view. It seems unlikely that my species should have the characteristic form of valve as illustrated by OESTRUP, L. 138, pl. 8, f. 99 a—e.

Distribution: Arctic, neritic form, known from Greenland, the Barents Sea and the Kara Sea.

N. arctica CL.
(Pl. VI, fig. 15).

CL. L. 26, p. 21, pl. 1, f. 21, 22.

Rather frequent, but always in small numbers, there occurs a species which it has been difficult to determine with certainty. It was noticed both in 1899 and 1900, but only during the inflow of diatoms, and is only entered in the tables for 1900, under the name of *N. recta* HANTZSCH, which is, however, a wrong one. I thought afterwards that it might perhaps be a straight form of the high arctic species *N. lævissima* GRUN., but finally held to the designation *N. arctica* CL.

I have also here observed a number of forms which are more like each other than the corresponding ones of *N. hybrida*.

The keel is very eccentric, the puncta very little lengthened in width, $7^{1}/_{2}$—10 on 10 μ, the two in the middle being more widely separated and there is a trace of a central nodule. The valve is narrow lanceolate, acuminate.

The cell in side view is long and narrow, linear, somewhat broader in the middle, with truncate ends. The connective zone longitudinally striated.

Varies much in length, 60—100 μ, the cell is 7—12 μ broad in side view, the valve 4—5 μ broad.

Strangely enough no striæ were to be seen. All the specimens I examined were, however, thin walled.

Seems to be with us a true plankton form.

Distribution: On the north east coast of Siberia (Cape Wankarema) and Davis Strait. Probably an arctic coast form.

N. angularis W. SM.
(Pl. VI, fig. 14).

W. SM. L. 134, pl. 13, f. 117. VH. L. 88, p. 177, pl. 62, f. 11—14.

Not a true plankton form. Cfr. the chapter on bottom samples.

Rare and scarce during the diatom inflow a little form occurred (Pl. VI, fig. 14, a, b), which answers well to *N. angularis var. kariana* GRUN. (L. 48, p. 89, pl. 5, f. 100). Length 36—54 μ.

(Lille Molla, $^{1}/_{4}$ 1899; Seivaagen, $^{5}/_{4}$ 1900).

N. spathulata BRÉB.

BRÉB. in W. SM. L. 134, I, p. 40, pl. 31, f. 268. VH. Synopsis (L. 88), p. 177, pl. 62, f. 7—8.

Very rare and only singly.

Not a genuine plankton form. Occasionally found in bottom samples. (Cfr. the corresponding chapter).

N. lanceolata W. SM.

W. SM. L. 134, I, p. 40, pl. 14, f. 118. VH. Synopsis (L. 88), pl. 68, f. 1—4.

Like the preceding species.

Pl. VI, fig. 13 represents a very small form, which answers very well to *N. lanceolata var. pygmaea* CL. L. 45, p. 481; L. 26, p. 22, pl. 1, f. 19, 20.

Length 30 μ, breadth 4 μ. The keel puncta are small and close together, about 14 on 10 μ, the two middle ones more widely separated, with a trace of a central nodule between them.

This form which occurred $^{1}/_{4}$ 1899 Lille Molla can, however, hardly belong to *N. lanceolata* on account of the keel puncta being so close together and also because of the distinct trace of a central nodule. CLEVE mentions this form from Cape Wankarema and Davis Strait.

N. longissima (BRÉB.) RALFS

Rare and occurs only in small numbers.

N. closterium (EHRB.) W. SM.

Of very rare occurrence in the samples.

It does not seem possible always with certainty to distinguish between this species and *N. longissima*.

Hardly a genuine plankton form.

Distribution: Common temperate coast form, widely distributed on the coasts of Europe.

N. Mitchelliana GREENL.

GREENLEAF L. 73, p. 107.

Only noticed a couple of times.

Not a genuine plankton form.

11. *Surirelleæ.*

Surirella TURP.

S. fastuosa EHRB. and **S. lata** W. SM.

are not genuine plankton forms. Cfr. the chapter on bottom samples.

Campylodiscus EHRB.

C. Thuretii BRÉB. and **C. angularis** GREG.

occur frequently in plankton samples and now and then not in small numbers, but they must, nevertheless, without doubt be looked upon as being accidentally brought in, as they are rather common in bottom samples.

C. Ralfsii W. SM. is also rather often found in plankton samples.

12. *Cocconeideæ.*

Cocconeis EHRB.

C. scutellum EHRB., **C. pinnata** GREG. and **C. costata** GREG.

occur only seldom and singly in plankton samples, and are probably accidentally brought in from fixed algae.

(Refer to bottom samples).

13. Achnantheæ.

Achnanthes sp.

Wrongly entered in the tables as *A. tæniata* Grun.

A. tæniata Gran L. 65, p. 9, pl. 1, f. 10?, non Grun. L. 48, p. 22, pl. 1, f. 5.

In long, very compact chains, which strongly remind one of *Fragilaria oceanica* and also show a similar comparatively coarse striation in side view.

I have only once succeeded in seeing the valve from above, and then it was very evident that the species must be another than Grunow's, the distinct striation being also a proof of this.

A. tæniata in the various publications on plankton seem to be different species, and one of them is probably the same as the one I have found. As I have not clearly seen the other valve, I will not venture to settle the species more definitely.

The genuine *Achnanthes tæniata* Grun. is, however, quite another species. By the kindness of the Riksmuseum in Stockholm, I have been enabled to examine the original preparations of bottom mud from the Kara Sea (cfr. Grunow l. c.). I have also had an opportunity of finding the species in some of the mud collected, and in this way I have become convinced that the species really does — as mentioned by Cleve — form long, compact chains (Pl. VIII, fig. 27).

Grunow's illustration, which is very correct, very considerably resembles *Navicula Vanhöffeni* Gran.

There are, doubtless, here very closely related species, but they form probably two, perhaps even three, quite distinct series. In this case, as so often, a remarkably large quantity of species is found in the arctic diatom plankton.

There are at least here four *Achnanthes* species which must be kept distinct. First we have Grunow's *Achnanthes tæniata*, which is comparatively thick-walled and strongly siliceous, and can therefore, hardly be the same as that which Oestrup mentions and illustrates (L. 139, pl. 2, f. 15) his being exceedingly thin-walled. Then we have the closely allied species *A. (tæniata var.?) hyperborea* Grun. L. 83, p. 50, pl. 1, f. 4, 5. As far as I can see, this is the same species as I have illustrated pl. VIII, f. 28, from 71° 48′ n. lat., 49° 38′ e. long. $^{31}/_{5}$ 1900 (Barents Sea, S/S Heimdal, a sample kindly given me by Dr. Gran).

To these must be added the form which I have found in our northern coast plankton and Oestrup's from Greenland.

Rather rare, but occurs in very long chains, only found during the inflow of diatoms in spring.

Distribution: *A. tæniata* is an arctic, neritic species (Greenland, Spitzbergen and Kara Sea), which also appears to occur occasionally in large numbers in the Baltic Sea.

14. Naviculeæ.

Navicula Bory.

N. directa Ralfs.

A. Schm. L. 128, pl. 47, f. 1—5.

Rather frequent during the inflow of diatoms in spring; but seldom occurs in any quantity. Is most likely a genuine plankton form.

Distribution: Widely distributed in various forms on the coasts of the Atlantic, right up to the arctic regions. Also on the west coast of Norway (spring, 1900).

N. kariana Grun.
(Pl. VII, fig. 21).

Cl. and Grun. L. 48, p. 39, pl. 2, f. 44.

Under this name, a species is entered in the tables which occurred frequently both in 1899 and 1900, but only at the time of the inflow of diatoms, and seldom numerous.

It is very thin walled, and most likely is a genuine plankton form. It has the usual two chromatophores, one on each side of the connective zone, symmetrically situated.

This form does not, however, answer well to the principal species and the illustration referred to, but very much better to *N. frigida* Grun. L. 83, p. 51, pl. 1, f. 25, which Cleve (L. 25) considers to be a variety of *N. kariana*.

The form which I have observed is, at any rate, closely allied to *N. kariana*. The same form occurred in the sample before mentioned from Barents Sea, S/S Heimdal, 1900, (cfr. under following species) in which the more thick-walled forms answered very exactly to *N. frigida*. Such a form is illustrated in pl. VII, fig. 21.

Distribution: *N. kariana* seems to be an arctic, and boreal neritic form, which also occurs in the North Atlantic. It is known from Greenland, Jan Mayen and the Kara Sea. The same form, which was found in the plankton from the northern coasts, also occurred in the spring 1900 on the west coast of Norway.

I have a few times noticed delicate chains of a diatom which is probably a *Navicula*, and very likely the species just mentioned (*N. frigida*). The chains were much twisted. (Pl. VII, fig. 21 f).

N. Vanhöffeni Gran.
(Pl. VII, fig. 22).

N. septentrionalis Cl. L. 40, non Oestr.

Frequent during the inflow of diatoms in spring, occasionally in large numbers. Otherwise absent.

I should think it rather certain that this species is not a genuine *Navicula*. As I cannot, however, at present find any better place for it, I have entered it under its usual name. In the tables, I tried at first to distinguish between *N. septentrionalis* and *N. Vanhöffeni*, as these are ordinarily understood, but I had to give it up later, and this is the case in the tables for 1900.

At any rate, there is only one species in the plankton under consideration. It is narrow boatshaped; but as the connective zone is very slightly siliceous, it does not stand being treated with acids (but very well being ignited on cover-glass) and it is, therefore, very difficult to get a valvar view of it.

As Gran (l. c.) mentions two species and under *N. septentrionalis* remarks that it may easily be recognized in side view by the plain stauros, it seems to me that the central nodule here suggests the possibility of a stauros, which perhaps does not exist. Gran does not illustrate any central nodule in side view in his figures of *N. Vanhöffeni* (f. 32 b). This nodule is, however, plainly to be seen on specimens in my material, which in every respect (when seen as chains) answer so remarkably well to *N. Vanhöffeni* that I have not the least doubt that they really belong to this species. With regard to the spaces between the links of the chains, they are, to be sure, most often seen in specimens, preser-

ved in formaline, when they have not been ignited on cover-glass; but they may be wanting and sometimes be also very distinct in one and the same chain. It appears to me, however, that they become smaller and may even disappear altogether during the process of igniting. They are, however, also often wanting in specimens preserved in formaline.

It has not hitherto been possible to see any definite structure. Cleve, who considers this species to be identical with Östrup's *N. septentrionalis*, has also mentioned that he has not been able to dissolve the structure. I have examined numerous specimens, most of them in side view, and have noticed a narrow linear stauroslike marking, which, however, was very indistinct, but I have not been able to discover anything further.

Rather frequent during the diatom inflow in the spring, sometimes numerous; otherwise wanting.

Distribution: Arctic coast form, known from Greenland and the Barents Sea (Heimdal 1900, cfr. Gran L. 70, p. 182). According to Gran (l. c.) *N. Vanhöffeni* was very frequent in the Siger Fiord in Vesteraalen $^{12}/_{4}$ 1901. Not observed on the west coast of Norway. According to Cleve (L. 40, p. 333) also found in the Baltic.

N. pelagica Cl.
(Pl. VII, fig. 23).

Cl. L. 26, p. 11, pl. 1, f. 9.

Was not so very rare in the plankton 1899. Only found in 1900 in one of the samples: The Salten Fiord, $^{5}/_{4}$, 0—330 m.

I have never succeeded in finding this species in material preserved in alcohol or formaline. I only know it from slides, where it has been ignited on cover-glass, and have never seen it in valvar view. It answers fully to Cleve's description and illustration, so that there can hardly be room for any doubt as to its being correctly determined.

The peculiar „hairs" are, according to my opinion, fragments of the complex connecting zone and probably appear only after being ignited on cover-glass (or treated with acids, which, however, seems to destroy the cells). Is certainly very closely related to *N. Vanhöffeni*.

Distribution: Arctic species, probably, like the foregoing, a coast form. Hitherto only known from Baffin's Bay, Davis Strait and the Barents Sea (S/S Heimdal $^{31}/_{5}$ 1900, r).

Stauroneis ***septentrionalis*** Grun.
(Pl. VII, fig. 24).

Grunow L. 83, p. 53, pl. 1, f. 48. *Navicula septentrionalis* Oestr. L. 139, p. 317, non Cl. L. 40; nec Cl. L. 48, p. 3, De Toni L. 50, p. 126, A. Schmidt L. 128, pl. 6, f. 37. *Libellus? septentrionalis* Oestr. L. 138, p. 439, pl. 8, f. 97.

This species does not occur in our northern plankton. As before mentioned, the species which Cleve several times (e. g. L. 40) mentions as *Navicula septentrionalis* Oestr., is identical with *N. Vanhöffeni* Gran, at any rate, in part. Judging from his remark on the contents of the cell (L. 65, p. 9) it would seem that Gran also considers a form which is closely related to *N. Vanhöffeni* to be *N. septentrionalis* Oestr., as he describes the contents of the cell in both cases as being the same. *Stauroneis septentrionalis* Grun. has, however, quite another inner construction (v. below).

As mentioned under the foregoing species, I earlier also considered a form to be *Navicula septentrionalis*, which I afterwards found impossible to definitely distinguish from *N. Vanhöffeni*. Preparations ignited on cover-glass (not treated with acids) always answer well to the description of *N. septentrionalis*, as the central nodule then becomes very distinct, and the spaces between the cells — as before mentioned — generally disappear.

A careful examination of the ends of the valve — cfr. pl. VII, fig. 22 and 24 — will show that there is, however, here a question of two very different species, for Oestrup's illustration never, in this respect, corresponds to the appearance of *N. Vanhöffeni*, as I have had ample opportunity of seing in numerous preparations of the latter.

It is easily explained that Oestrup's species might be confused with *N. Vanhöffeni*, as he — although very much in doubt, as he has himself observed — refers the species to the genus *Libellus*. Soon after he changes the name of the genus, probably because Cleve in the meanwhile (L. 26) has referred it to *Navicula*. Oestrup neither illustrates nor mentions the connecting zone as being complex. As, however, the almost simultaneously discovered *N. Vanhöffeni* has a distinct complex connective zone, and was also found to occur as a pelagic species in long chains, it was very easy to confound these two species.

For the first time I was aware that a species exists, which answers very precisely to Oestrup's drawing, by the previously mentioned plankton sample from the Barents Sea (S/S Heimdal, $^{31}/_{5}$ 1900). Gran mentions this sample in his last work (L. 70, p. 147) and enters both *N. Vanhöffeni* and *N. septentrionalis* Oestr. from this place. There was, however, in this sample, a larger species with the same characteristic chromatophores as in *N. Vanhöffeni* and also with a distinct stauros, which was easily seen in water. As far as I can see, this must be a new species, which I have described below.

That the species represented on pl. VII, f. 24, is the same as *Stauroneis septentrionalis* Grun., I see no reason to doubt, the more so as they were both found in the same waters. (Grunow's species was found on the ice on the west of Novaja Semlja). The species seems to have a partiality for the neighbourhood of ice.

As it has not previously been found as a pelagic species in chains, I adjoin the following short description.

Valve linear, more or less distinctly cuneate towards the ends, which are either broad and rounded or almost square. Length 22—27 μ, width 4—5½ μ.

There is a distinct central stauros, which does not reach right out to the sides of the valve, bounded by two lines, which are parallel nearly out to the edge, where they are clearly divergent. Between them near the margin are 1—2 short, coarse striæ, similarly radiating. The rest of the valve is transversely striated; the striæ, however, are only seen with difficulty, with the exception of those which are more widely separated in the middle. Forms long, firm chains where the cells lie very close to each other, also at the corners. On being ignited on cover-glass the chains break and the ends of the cells become slightly separated from each other. (Cfr. pl. VII, f. 24.)

Contents of the cell: As far as can be seen from the preserved specimens, from the central protoplasm mass in which the nucleus lies extend upper and lower arms (probably 4 in all, 2 upper on either side and two lower). Whether these unite to form the usual chromatophores which are found on the connecting zone in the genus *Navicula*, I have not been able to decide. But the

remarkable contents of the cells of *N. Vanhöffeni* are at any rate not found here.

Achnanthes hyperborea Grun. is a puzzlingly similar species. Grunow mentions too that *Stauroneis septentrionalis* might perhaps be the lower valve of an *Achnanthes*. It appears, however, that he, both in this instance and with regard to *Achnanthes tæniata*, at once came to the correct conclusion.

As before mentioned, *Achnanthes hyperborea* was also found in the sample from the Barents Sea, but only in small numbers.

Judging from my experience, it would seem possible that there is yet another species, answering to *N. septentrionalis* Oestr., to be found in the bewildering wealth of species in the arctic, neritic, diatom plankton. As, however, the difference between Oestrup's species and *Stauroneis septentrionalis* seems to be so slight, I have thought it best at any rate for the present, to consider them to be synonymous.

Stauroneis Grani Jörg. n. sp.
(Pl. VII, fig. 25).

Forms chains in which the cells touch each other except towards the ends, where the cell in side view appears to be narrowed off uniformly (outlines arched).

On being ignited on cover-glass, the connection is still further severed, so that the cells only touch each other in their middle half (more or less). The ends are sharply bent so that the cells of the chains in material preserved in alcohol look as if the ends were cut off in a straight line by a sharp knife.

There is a small central stauros, bounded by two parallel lines. No other structure was seen on the valve.

The connecting zone complex as that of *Navicula Vanhöffeni*. As in the latter species, the connecting complex membranes are seen between the ends of the cells. They are, however, as a rule rather indistinct.

The contents of the cell are generally speaking the same as in *Navicula Vanhöffeni*, with which species *Stauroneis Grani* is very nearly related.

Length 54—57 μ.

I have not been able to identify this species with any of those hitherto known. It may perhaps be the same as that which Gran L. 70, p. 147, mentions from the Barents Sea, $^{31}/_{5}$ 1900, as *Navicula septentrionalis*. It does not, however, appear to be identical with the one which he mentions from Greenland L. 65, p. 9, as the above species is considerably larger.

Moreover, the only species with which, according to my opinion, it would be possible to unite it, would be *Stauroneis pellucida* Cl., which species is mentioned by Cleve from Cape Wankarema (L. 45, pl. 35, f. 10). Cleve's illustration, however, resembles it very little; the species is though, according to Oestrup (L. 138, p. 440) exceedingly variable.

Occurred singly in one sample: Porsangerfjord, $^{27}/_{4}$ 1899, 0—75 m.

Distribution: Hitherto otherwise only known from the Barents Sea, 71° 48′ n. lat., 49° 38′ e. long. (S/S Heimdal $^{31}/_{5}$ 1900). I have also seen a short chain from the Kara Sea (the Swedish Jenissei expedition, 1875). In this slide, there was also a short chain of the species which I have entered as *Stauroneis septentrionalis* Grun.

Schizonema *Grevillei* Ag.

Only by accident brought in with higher algae. Common among bottom algae on the west coast of Norway.

Pleurosigma W. Sm.

P. angulatum (Quek.) W. Sm. and ***P. Normanni*** Ralfs (= *P. affine* Grun.)

Not genuine plankton forms, only accidentally brought in.

The latter species is very frequent in bottom samples.

Also occur now and then singly in the plankton *P. formosum* W. Sm. and *P. balticum* (Ehrb.) W. Sm.

P. tenerum Jörg. n. sp.
(Pl. VII, fig. 17).

P. Stuxbergi Cl. L 48, p. 54. pl. 4, f. 74 (?).

Under this name, a species is entered in the tables which certainly is a genuine plankton form, as in some of the samples (Rombaken $^{8}/_{2}$ and Skjomen $^{9}/_{2}$ 1899) it was quite common, and occasionally occurred in large quantities. It was also now and then found during the inflow of diatoms in the spring, especially in 1900, but then always in small numbers.

The species corresponds so well, in all important points, with *P. Stuxbergi* Cl. and Grun., that I have been in doubt as to whether or not it should be entered under that name. Finally I came to the conclusion that I ought to do so, as will be seen on reference to the tables for 1900.

There were, however, chiefly three things which made me provisionally enter it as a separate species. First, because it is one of the few species of *Pleurosigma* which is really planktonic; secondly, it is very thin walled and is easily deformed when ignited (a fact not mentioned with regard to *P. Stuxbergi*) and finally, Cleve classifies his species under the division *Rhoicosigma* (L. 24, p. 41), while I was convinced by examination of preserved material that, seen in side view, it is not bent.

When ignited on cover-glass, it loses — as already mentioned — its shape, and I have often seen specimens which, after being treated in this way, give the impression of being a *Rhoicosigma*.

Distribution of *P. Stuxbergii:* Greenland, Frantz Joseph's Land, Kara Sea. Probably an arctic coast form.

P. delicatulum W. Sm.
(Pl. VII, fig. 18).

Very like *P. karianum* Grun. L. 48, p. 50, pl. 3, f. 69, which is referred as a variety to *P. delicatulum* W. Sm. by Grunow with some doubt, and to *P. elongatum* W. Sm. by Cleve. It is also very like *P. fallax* (Grun.) Perag., which is considered a variety of *P. elongatum* both by Cleve and Grunow. These forms, however, all differ from the one observed by me by the transverse striæ being closer than the oblique ones, while the contrary is rather the case in my form.

Very rare: $^{4}/_{4}$ 1899 Fölstad, 0—3 m. Very closely allied forms also occur, but always very sparsely (and only during the diatom inflow).

P. tenuissimum W. Sm. var. **hyperborea** Grun.
(Pl. VII, fig. 19).

Grun. L. 48, p. 58, pl. 4., f. 77.

Answers well to Grunow's illustration and description, but is also very like *P. Spenceri* W. Sm. *var. borealis* Grun. l. c. p. 60, pl. 4, f. 79.

Very scarce and rare: Lille Molla, 1/4 1899, near the surface; Fölstad 4/4 1899, 0—3 m.

Distribution: The Kara Sea.

P. fasciola (Ehrb.) W. Sm. and **P. tenuirostre** Grun.

Both these species, the latter of which is considered to be a form of the former both by Cleve and others, occur occasionally during the spring diatom inflow, but always very sparsely. It is doubtful if these species really are plankton forms. *P. tenuirostre* seems to be the more frequent.

Strange to say, I once saw oblique striæ very close to each other (but only in one direction), closer than the transverse striæ, about 27 on 10 μ. The transverse striæ were only discernible near the raphe, about 20 on 10 μ. Longitudinal lines were only to be seen at the ends, somewhat wavy (Pl. VII, f. 20).

Generally speaking, striæ were not seen in the specimens (which were thin walled), so that I cannot decide whether the difference mentioned between *P. fasciola* and *P. tenuirostris* holds good with us or not. At any rate, the shape of the latter species is very characteristic.

Distribution: *P. fasciola* is widely distributed on the European coasts. *P. tenuirostris* is an arctic form, known from Greenland and the Kara Sea.

P. naviculaceum Bréb.

Not a genuine plankton form. Refer to bottom samples.

Rhoicosigma ***arcticum*** Cl.

Rare and scarce. Hardly a genuine plankton form. Seems to be a frequent bottom form on the west coast of Norway, and probably also on the north coast. Refer to bottom samples.

Auricula ***complexa*** (Greg.) De T.

Only once found, singly: Rombaken 8/2 1899, 0—40 m.

Distribution: The coasts of Great Britain. Rare on the west coast of Norway. Also mentioned from Barbadoes.

II. Peridiniales.

1. *Prorocentraceae* Stein.

Prorocentrum ***micans*** Ehrb.

Only once found, very scarce: Henningsvær, 17/1 1899, 0—180 m. On account of its small size it goes through the net.

Distribution: Probably a coast form from the temperate European coasts of the Atlantic and its arms. Known from the North Sea, (from the English Channel, not rare, May 1903 L. 18, IV), Skagerack, the Baltic and the west coast of Norway, here rather scarce. Probably brought to us from southern coasts.

Dinophysis Ehrb.

D. acuta Ehrb., Jörg.

Jörg. L. 91, p. 28, pl. I, f. 2.

Rather common in the samples, but always rather scarce.

Distribution: Seems to be a northern, but not an arctic, form, which is frequent both in the open sea and on the coasts. Known from the waters between Norway, Scotland, Iceland and Greenland as well as from the North Sea, Skagerack and the Baltic. It appears to be stationary on the west coast of Norway and near the Faeroe Islands and Iceland, probably also on the northern coasts of Norway, where it has been found at several places by Gran in the summer and autumn months. (Cfr. Gran L. 67).

D. norvegica Clap. et Lachm., Jörg.

Jörg. L. 91, p. 29, pl. 1, f. 3—6.

Occurs in many of the samples, but always in small numbers.

Distribution: Not sufficiently known. The species, however, appears mostly to have the same distribution as *D. acuta.* Seems to be a northern form. Known from the North Sea (from The English Channel, r May 1903), Skagerack and Cattegat, Scotland, Jan Mayen and the west coast of Norway, where it is found, but only sparsely, during nearly all the months of the year.

D. acuminata Clap. et Lachm., Jörg.

Jörg. L. 91, p. 30, pl. I, f. 7—9. *D. Vanhöffeni* Ostenf.

Very rare and scarce.

Distribution: Not sufficiently known. Seems to be a northern form, but scarcely native with us. Rather frequent on the west coast of Norway in the summer and autumn (of 1898), but generally scarce. Also known from Greenland, Iceland, the Faeroe Islands (very rare) and the Baltic Sea (Levander).

Perhaps it comes to our west coast from Iceland.

D. rotundata Clap. et Lachm.

D. Michaelis auct p. p.

Rare and scarce. Found in small numbers by Gran (L. 67) at several places on the northern coast of Norway in the months of July—October 1898—99.

Distribution: Seems to be a northern, oceanic form. Known from the North Sea (southwards to the English Channel, r in February and May 1903), Skagerack and also mentioned from the Baltic. On the west coast of Norway in the months of April—December 1898, always in small numbers.

D. homunculus Stein.

Stein L. 135, pl. 21, f. 1—8.

Only found in one of the samples (two individuals). Helligvær 12/1 1899, 0—50 m.

Distribution: Widely distributed in the warmer parts of the

temperate Atlantic, and only occasionally and exceptionally carried as far north as Lofoten.

Does not occur on the west coast of Norway.

Podolampas *palmipes* STEIN.

Very rare and only singly: The Vest Fiord I, 13/1 1899 0—50 m. and 0—180 m.), Tranödybet 22/3 1900, 0—600 m. and The Folden Fiord 6/4 1900, 0—530 m. With us a form which is only accidentally and exceptionally brought in from the south.

Distribution: Oceanic form, widely distributed in the tropical and temperate parts of the Atlantic, northwards in the summer (cfr. CLEVE L. 40, p. 276) right up to near Iceland. On the west coast of Norway very rare and only singly. Seems to be cosmopolitan in all the warmer seas, as it is also mentioned from the Mediterranean, the Red Sea, the Indian Ocean and the Pacific Ocean.

Oxytoxum *diploconus* STEIN.

Only one specimen found (therefore determination not fully reliable): The Skjerstad Fiord V, 2/4 1900, 0—420 m.

Like the foregoing, an accidental southern form.

Distribution: Southern oceanic form, from the warmer parts of the temperate Atlantic. On the west coast of Norway also only once found in 1898.

Pyrophacus *horologium* STEIN.

Rare and scarce; found, however, in several samples. Seems to be entirely absent during the spring diatom inflow; then it was only found in one deepwater sample from one of the fiords: The Folden Fiord 6/4 1900, 500—400 m.

Distribution: Southern form, according to CLEVE, properly a tropical oceanic form. Probably has a wide distribution in the warmer temperate waters of the Atlantic. As it is easily overlooked, its distribution is hardly yet quite sufficiently known.

Its comparative frequency on the coasts of Norway might suggest either that it is able to thrive well in the coast waters at our latitudes, or that there are two different species of which the one is a tropical oceanic one not occurring with us.

Gonyaulax *spinifera* (DIES.) CLAP. et LACHM.

Very rare and scarce, only found in some few of the samples: The Ögs Fiord, 14/3 1899, 0—90 m., in the sea off Senjen 13/4 1899, 0—80 m., Höla 20/3 1900, 0—50 m.; Balstad I, 21/3 1900, 0—50 m.; The Skjerstad Fiord XII, 0—500 m.

Distribution: Is considered by CLEVE to be a neritic species.

There seems to be, judging from CLEVE's accounts (L. 40, p. 249), two different species, a boreal or arctic species and a more southerly one, which is probably oceanic. Its occurrence on our northern coasts also suggests that our species is oceanic.

GRAN (L. 67) mentions *Gonyaulax spinifera* as occurring in small numbers in the Eids Fiord (Nordland) in the months of July—September 1898—99.

Two species occur also on the west coast of Norway (cfr. E. JÖRGENSEN L. 91, p. 34). The lesser of these is also found in the Baltic.

Protoceratium *reticulatum* (CLAP. et LACHM.) BÜTSCHLI.

Very rare and generally in small numbers. As it is, however, so small that it is not retained by the net, it is probably found more frequently than appears.

Was found in 1900 principally in deep water samples.

Distribution: Not sufficiently known. Is considered by CLEVE (L. 40, p. 277) to be a neritic northern or arctic form. It is found most frequently on the American side. On the west coast of Norway in 1898, generally very scarce.

Diplopsalis *lenticula* BERGH.

Rather frequent, especially in tolerably deep water, often rather numerous. Seems to be altogether absent during the spring diatom inflow. GRAN (L. 67) found it at several places on the northern coast of Norway in the months of July—October 1898—99, but generally in very small numbers.

Distribution: According to CLEVE, a southern oceanic species, widely distributed in the warmer parts of the temperate Atlantic. Also known from the North Sea (from The English Channel. Feb. and May 1903) and the Cattegat. Rather frequent on the west coast of Norway (1898).

Peridinium EHRB.

P. depressum BAIL.

Very frequent, often in quantities. Much scarcer during the spring diatom inflow. GRAN found it at Bodö and in the Eids Fiord in the months of July—October 1898—99 frequently.

Distribution: Seems to be an arctic and boreal neritic species, which is stationary both on the north and west coast of Norway. Widely distributed in the colder part of the northern Atlantic, chiefly on the coasts, from the American side, to Greenland, Iceland, (Faeroe Islands, the North Sea), Norway and right up to Spitz-bergen and Novaja Semlja.

P. oceanicum VANHÖF.

Surely a good species.

Was not so rare in 1899, but always in small numbers. Not noticed in 1900. Absent during the spring diatom inflow.

Distribution: Southern oceanic species which, according to CLEVE is widely distributed in the warmer part of the temperate Atlantic, and penetrates northwards right up to Greenland. Very rare and scarce round the Faeroe Islands and on the west coast of Norway. Also known from the Red Sea and the Indian Ocean.

P. divergens EHRB.

P. lenticulare (EHRB.) JÖRG. L. 91, p. 37.

As this species is now in most works on plankton mentioned under the name of *P. divergens* EHRB., I have, at any rate provisionally, found that I ought to use this name instead of the more explicit one, *P. lenticulare*. I hope in a later work to be able to

give a more detailed description of the species of *Peridinæa* which occur on the coasts of Norway, but as this work is, as yet, only in its beginning, I have tried as far as possible to use the accepted names, even if I do not always agree with them.

Common, often in quantities, except during the spring diatom inflow, when it is rather rare and scarce. Gran found it at several places on the northern coasts of Norway in the months of July—October 1898—99.

Distribution: According to Cleve, this is a southern, oceanic form, widely distributed in the warmer part of the temperate Atlantic, northwards to Iceland, Scotland, the North Sea, Skagerack, Cattegat, the west coast of Norway and (sometimes) right up to Spitzbergen.

It is stationary on the whole of the coast of Norway, and especially on the west coast frequent in the summer and autumn.

P. conicum (Gran) Ostenf. et Schm.

Ostenf. et Schm. L. 117, p. 174. Gran L. 70, p. 189, f. 14. *P. divergens var. conica* Gran L. 67, p. 47. *P. lenticulare v. Michaelis* (Ehrb.) Jörg. L. 91, p. 37.

Undoubtedly a good species.

Occurs in rather a large number of the samples, but quite exceptionally in any quantity. Gran found it in the Eids Fiord (Nordland) in rather small numbers in the months of July—August and October 1898—99.

Distribution: Gran (L. 70, p. 190) considers it to be a temperate Atlantic oceanic form, which also seems to agree to my material. On the west coast of Norway it is found all the year round, but generally only in small numbers. Found in the English Channel (February and May 1903), off Scotland, in the North Sea, the Skagerack and Cattegat and the Baltic, as well off Beeren Eiland (very sparsely).

P. pentagonum Gran.

Gran L. 70, p. 191, f. 15.

I know this form very well from the west coast of Norway, where it occasionally is abundant, but I have been in some doubt as to whether it should be looked upon as a young, undeveloped form or a special species.

Occurs rarely and in small numbers, but is possibly overlooked.

Distribution: Not sufficiently known. Gran is probably right in considering it to be a northern form. In 1898, it was occasionally abundant on the west coast of Norway.

P. pallidum Ostenf.

Ostenf. L. 111, p. 60; L. 116, p. 581, 582, f. 130, 131.
P. pellucidum (Bergh) Jörg. L. 91, p. 38. Gran L. 70, p. 186.

I agree with Ostenfeld in considering this species to be different from the following one but not with respect to the use of the name *P. pellucidum* (Bergh). As it is, however, excellently described by Ostenfeld (l. c.), it will be most practicable for the present to use the names he does.

Rather frequent, but generally in small numbers. Found by Gran at many places on the northern coast of Norway in the months of July—October 1898—99, but only in small numbers.

Distribution: Arctic and boreal (properly neritic?) species, known from the North Sea (from The English Channel, frequent in May 1903), Skagerack and Cattegat, the west coast of Norway, Scotland, the Faeroe Islands, Iceland, Greenland, Jan Mayen and Spitzbergen. Stationary on the west coast of Norway, especially numerous in the summer months.

P. pellucidum Ostenf.

Ostenf. L. 116, p. 58, f. 129.

There are several species which are more or less allied, which may easily be confused with this form. Besides, on account of its minuteness, it easily passes through the net, and is therefore not specially tabulated.

It was, however, only occasionally found in the samples.

Distribution: Seems to be an arctic and northern temperate (boreal) species, which is by Ostenfeld considered to be neritic. According to Cleve L. 40, p. 268, it has been found at many places on the American side up to Greenland and Spitzbergen. Occurs also on the west coast of Norway (in April and May 1901).

P. pedunculatum Schütt.
(Pl. VIII, fig. 29).

Shape: In dorsal view the upper half is broadly conical, with a rather long cylindrical apical tube. The lower half is broadly conical, the outlines showing a shallow sinus on each side and at the lowest part. In side view the upper half is still conical, the outlines of the lower being rounded, and then evenly narrowed, most clearly on the posterior side, towards a broad, rounded lower part. The dorsal half is larger and more prominent than the ventral. The excurrent basal spines are somewhat nearer the ventral side.

Girdle: The girdle in side view is almost in right angle to the longitudinal axis. On the ventral side the left end lies lower than the right, about as much as a piece equal to the height of the girdle. Definite radial rays (thickenings).

Basal spines: The basal spines are directed somewhat forwardly (towards the ventral side), especially the left one. Both broadly alated, the ventral wing being all at once broader towards the base, so that its contour turns almost at right angles to the direction of the spine (as is the case in Podolampas palmipes). In this way, in certain positions, the species appears to have a short, broad winged „foot" between the two others.

Contents of cell: The same in colour as in *P. pallidum.*

Dimensions: Width 47 μ, height 51 μ. Basal spines 17 μ prominent.

As yet, I have only seen few specimens of this species. Neither am I sure that it is identical to Schütt's, so that I have given a description, which, however, should only be taken as a preliminary one.

The peculiar suddenly broadened wings at the base of the ventral side of the basal spines are only seen with difficulty, but the one which belongs to the left spine is easily seen when the species lies on its ventral side with the apical tube down (and the spines up). As far as I have been able to see this wing on the left spine is directed out towards the right, on the right one, on the contrary, but little to the left, almost forwardly (ventrally).

The long apical tube has a very characteristic form in Schütt's figure. This form is also found in my specimens, but is due to seams, not to the actual contour.

It may be a question as to whether my specimens belong to *P. tristylum* Stein, a species which I do not know, but which, at

any rate, cannot be identical to *P. pellucidum* BERGH, as mentioned by BÜTSCHLI (L. 19). *P. tristylum v. ovata* SCHRÖD. is undoubtedly another species.

Very rare and very scarce; occurred together with oceanic and southern forms in Tranödybet $^{22}/_{3}$ 1900, 0—600 m. The same form is very rare on the west coast of Norway: The By Fiord of Bergen $^{30}/_{1}$ 1901, 0—400 m.; The Oster Fiord, $^{3}/_{9}$ 1901, 25—50 m., 100—200 m. I have also seen it from the Stor Fiord in Søndmøre (S/S Michael Sars 1900, st. 3, 100—30 m.).

P. pedunculatum is, according to CLEVE, a southern temperate, oceanic species, distributed in the Atlantic from rather far south northwards to the neighbourhood of Iceland (rarely).

P. Steinii JÖRG.

JÖRG. L. 91, p. 38. *P. Michaelis* STEIN L. 135, p. 9, f. 9—14, non EHRB. CL. L. 40, p. 263.

Occurs in quite a large number of the samples, but always sparsely. The species seems to be absent during the spring diatom inflow. According to GRAN (L. 67) in small numbers in the Eids Fiord and Ofoten in the months July—August 1899.

In the tables it is reckoned together with another smaller form, which is probably specifically different from the genuine *P. Steinii*, and seems to have a more northern distribution.

Distribution: Southern oceanic form, which, according to CLEVE, is widely distributed in the warmer (eastern) part of the temperate Atlantic, northwards to Greenland, Iceland and towards Spitzbergen. Very scarce round the Faeroe Islands. Also rare on the west coast of Norway, where there occurs (at least) two different species.

P. ovatum (POUCH.) SCHÜTT.

Frequent, often numerous. Found by GRAN on the northern coasts of Norway, rather numerous at several places in the months of July—September 1898—99.

Distribution: Seems to be an arctic and northern temperate (boreal), chiefly neritic (?) species, which is known from the coasts of Western Europe, the North Sea, Skagerack, Cattegat, the Baltic, the west coast of Norway, the Faeroe Islands, Iceland, Greenland and Spitzbergen. Stationary on the coasts of Norway, being especially common on the west coast in the months of April and May.

Ceratium SCHRANK.

As most of the easily recognized forms of *C. tripos* are now, by almost all plankton investigators, mentioned as distinct species, I have thought it best to do so too, as far as possible. I am, however, inclined to think that by so doing we get a basis which is rather uncertain. On the other hand, it seems that one really goes too far when one considers all „forms" of *Ceratium tripos* (e. g. balticum and macroceros) as one species. As, however, the so-called species are very difficult to characterize well (naturally), the result will be that there will be numerous species, and one gets into a hopeless chaos, as we have already seen in the case of one author. According to my opinion, therefore, the only practical solution will be to set up as few „species" as possible, but to classify the divergent forms as „varieties". It will, I think, for the sake of clearness, also be necessary to arrange the varieties in groups, as more new forms are appearing.

C. tripos (O. F. MÜLL.) NITZSCH.

C. t. α balticum SCHÜTT.

Common and generally in large quantities; during the spring diatom inflow, however, very much scarcer than at other times. Found by GRAN at several places on the north coast in the months of July—October 1898—99, usually numerous.

Distribution: According to CLEVE, widely distributed in the warmer part of the temperate Atlantic, from whence it extends northwards. Very frequent on the coasts of the North Sea, Skagerack and Norway; as an exception, as far north as Spitzbergen. Stationary on the coasts of Norway.

The form which is found in the Baltic is, according to OSTENFELD, L. 116, p. 583, 584, f. 132, 133, 134, somewhat different to the North-Atlantic one.

C. bucephalum (CL.) CL.

CL. L. 40, p. 211. *C. tripos var bucephalus* CL. L. 46, p. 302, f. 5. *C. t. arcuatum* (GOURR.) JÖRG. L. 91, p. 44, pl. 2, f. 11, non *C. arcuatum* GOURR. L. 63, p. 25, pl. 2, f. 42.

Seems to be a well characterized and little varying form, which without difficulty can be considered as a separate species. Occurs together with the preceding, and almost exactly corresponds to it in frequency.

Distribution: In all important respects, like the preceding species; but appears to be more westerly. Seems to be absent round the Faeroe Islands, and is much less frequent on the west coast of Norway than the preceding species.

C. bucephalum (CL.) CL. var. *heterocampta* JÖRG.

C. tripos ε arcuatum forma heterocampta JÖRG. L. 91, p. 44, pl. 2, f. 12. *C. tripos var. arietinum* CL. L. 36, p. 13, pl. 7, f. 3.

Not noticed in the samples from 1899; in several samples from 1900 and occasionally rather numerous.

Distribution: Southern oceanic species, according to CLEVE (L. 40, p. 209) widely distributed in the warmer part of the Atlantic and also known from the Indian Ocean. Frequent on the west coast of Norway in 1898 in the months of September—December; singly in February.

C. macroceros (EHRB.) CL.

Frequent and numerous (less so during the spring diatom inflow), but much scarcer than the two foregoing species. Found on the northern coast together with them during the summer and autumn 1898—99 by GRAN.

Distribution: In the Atlantic, in all important respects like *C. bucephalum*. Has not been found either round the Faeroe Islands. All the year through on the west coast of Norway, but much less frequent than *C. tripos* (maximum in summer). Occasionally noticed at Spitzbergen (in the warmer waters). Also known from the Indian Ocean.

C. intermedium (JÖRG.)

C. macroceros forma intermedia JÖRG. L. 91, p. 42, pl. 1, f. 10. *C. tripos var. scotica* OSTENF. L. 111, p. 57, non SCHÜTT. *C. horridum* GRAN L. 70, p. 194, non *C. tripos var. horrida* CL. L. 46, p. 302, f. 4.

There is already a considerable accumulation of names (and corresponding confusion?) in connection with this form, which will be difficult to keep separate from the foregoing, as it, as mentioned in a previous paper (Jörgensen L. 91, p. 42), varies considerably.

I cannot help discussing here once more, whether the names above mentioned are justifiable, as the last change of name will easily give rise to a state of chronic confusion.

I believe everyone except perhaps Ostenfeld, agrees that Schütt's name ought not to be used. Even if the illustration referred to by Ostenfeld be taken as the principal figure (Schütt L. 130, p. 70, f. 35, IV), it must not be overlooked that Schütt has in the same work at another place (p. 28, f. 20, IV c) illustrated the foregoing species as *v. scotica.* It was this circumstance which made me decide to keep my own name instead of the one already published by Ostenfeld.

Also Cleve (L. 40, p. 301) and Bruno Schröder (L. 129, p. 15) look upon Schütt's var. scotica as I do.

There must either be a printer's mistake in one or other of Schütt's two illustrations, or the name *scotica* must be used in reference to a large series of forms.

In L. 112, p. 56, Ostenfeld enters *Cerat. tripos v. horrida* Cl. as a form under *C. t. v. „scotica* Schütt". He remarks that its straight (not curved) apical horn brings it close to this variety, and that the presence or absence of spines is a very varying and unreliable character.

With this latter remark, I agree entirely (cfr. L. 91, p. 42 under *C. t. m. f. intermedia).* Judging from my experience, it seems that *var. horrida* Cl. can hardly be kept distinct as a variety, and it will be seen (L. 40, p. 227) that Cleve too has come to the same conclusion. But Ostenfeld's reference to the straight apical horn, must arise from some mistake (which I confess I find it difficult to explain), as Cleve's figure (L. 46, f. 4) clearly shows the curved horn which is typical for *C. longipes* Bail. (= *C. t. v. tergestina* Schütt, cfr. under *C. longipes).*

All the forms illustrated by Ostenfeld, L. 116, p. 585, f. 136—139, belong to my *C. intermedium*, as was my earlier interpretation of this form as a variety (l. c. where the forms are of equal value to the varieties in this paper, and the varieties equal to the species here). *C. intermedium* in the tables is also taken in this meaning, and includes all Ostenfeld's forms.

Strange enough, the same mistake is also repeated by Gran (L. 70, p. 195) matters being brought to a head by the use of the name *C. horridum* for the whole series of forms.

Cleve (L. 40, p. 225), on the contrary, enters *var. horrida* under *C. t. var. longipes* Bail.

Is the series in question to be considered as one species — which, as mentioned above, will perhaps not be realisable — I cannot see but that the name *C. intermedium* must be resumed.

Cleve (L. 40, p. 225) evidently considers the forms in question to belong under *C. macroceros* (in agreement with my previous opinion).

On the whole, very frequent, almost precisely corresponding in frequency to *C. macroceros*, though sometimes a little scarcer. Very scarce during the spring diatom inflow, altogether absent in 1899.

Distribution: Appears in all important respects to be the same as that of *C. macroceros.* In the Norwegian Ocean, however, not noticed (by me, at any rate) so far north. Frequent on the west coast of Norway.

C. longipes (Bail.) Cl.

C. tripos v. tergestina Schütt. Incl. *C. tripos v. horrida* Cl., non *C. horridum* Gran.

As mentioned in an earlier work (L. 91, p. 43) Bailey's *Peridinium longipes* seems to answer best to Cleve's *C. tripos v. horrida.* This variety is quite typical in the Arctic Sea, but at lower latitudes appears to pass entirely into *C. tripos v. tergestina.* From this circumstance, I cannot either see any reason why Bailey's name for the whole series of forms should not be used as in fact it now is by almost all authors on plankton.

This form also varies so much that it will be difficult to limit it. Cleve still enters it in L. 40, p. 225 as *C. t. var. longipes.*

Very frequent, often in large numbers, more frequent than *C. macroceros* and *intermedium*, about the same as *C. tripos;* in February—March and during the diatom inflow more frequent than the latter species. Also found by Gran, rather numerous, in the months of July—October 1898—99 at several places on the north coast.

Distribution: Northern temperate form, which is especially found in the coldest part of the northern Atlantic and in the confines towards the arctic waters, as well as in the north eastern arms, the North Sea (frequent in the English Channel in Feb. 1903, less so in May), Skagerack, Cattegat and the Baltic. Frequent between Greenland, Iceland, the Faeroe Islands, Scotland and the coast of Norway to Spitzbergen (cfr. Cl. L. 40, p. 225) and Jan Mayen. In these northern waters the form *horrida* Cl. appears to be most frequent. Common on the west coast of Norway, especially in the spring months after the diatom inflow (April—June 1898).

C. arcticum (Ehrb.) Cl.

Very rare, only found in two samples:

Strömmen II, (Henningsvær) 13/3 1899, 0—30 m., r; Sea off Röst (Vesteraalen) 22/3 1899, +.

Distribution: Arctic species, neritic and oceanic, especially frequent at Spitzbergen and Greenland and in the boundaries between the arctic and Atlantic waters (cfr. Gran L. 70, p. 50—52 and L. 69, p. 10).

Occurs in the sea between Norway and Jan Mayen, but only occasionally comes near the coast, mostly in deep water. According to L. 18, IV singly in the North Sea and off Scotland, May 1903. Absent round the Faeroe Islands. It is also wanting on the west coast of Norway (only on one occasion observed off the north western coast, as far down as the Sönd Fiord.

C. furca (Ehrb.) Duj.

Very frequent, usually rather numerous (the frequency varies considerably from r to c), much scarcer during the spring diatom inflow. Found frequently at several places on the north coast in the months of July—October 1898—99 by Gran.

Distribution: Temperate oceanic form, extending from the warmer part of the Atlantic, the North Sea, Skagerack, Cattegat, the Baltic, the west coast of Norway, Scotland, Iceland to the most northern part, (not in the arctic waters). Common on the west coast of Norway, often in quantities in late autumn. Rather

scarce off the Faeroe Islands. Also known from the Pacific Ocean, the Indian Ocean and the Red Sea.

C. lineatum (EHRB.) CL.

Is undoubtedly a good species.

Rare and scarce, almost entirely absent during the diatom inflow in the spring.

Distribution: Oceanic form, principally distributed in the warmer part of the temperate Atlantic, northwards (in the autumn, according to CLEVE) to Iceland and Greenland. Very rare round the Faeroe Islands. Often rather frequent on the west coast of Norway. Also known from the Red Sea and the Indian Ocean. In the north eastern Atlantic found as far as the sea between Tromsö and Jan Mayen (JÖRGENSEN L. 92, p. 36, rr).

C. fusus (EHRB.) DUJ.

Very frequent and often in quantities, only less numerous during the spring diatom inflow. Found by GRAN frequently at several places on the north coast in the months of July—October 1898—99.

Distribution: Temperate, oceanic form, widely distributed from the southern part of the temperate Atlantic to the North Sea, (rather frequent in the English Channel in the months of February and May 1903) Skagerack, Cattegat, the Baltic, the west coast of Norway, Scotland, the Faeroe Islands, Iceland and right up to Bären Eiland and Spitzbergen (1900). Rather common round the Faeroe Islands. Numerous on the west coast of Norway, especially in late autumn.

III. Pterospermataceae.

Pterosperma POUCH.

These remarkable organisms are probably, as CLEVE and others have suggested, resting stages. As far as I know, no one has up to the present found anything to indicate where they really belong.

With us, there are others (occurring sparsely) besides the three mentioned below, but I have not entered them.

P. Möbii (JÖRG.) OSTENF.

OSTENF. L. 117, p. 151. *Pterosphæra Möbii* JÖRGENSEN L. 91, p. 48.

Rather frequent, but generally sparsely.

Distribution: Not sufficiently known. Seems to be a temperate Atlantic form. Very rare round the Faeroe Islands. Also rare on the west coast of Norway.

P. Vanhöffenii (JÖRG.) OSTENF.

OSTENF. L. 117, p. 151. *Pterosphæra V.* JÖRGENSEN l. c.

Rather more frequent than the foregoing, and often rather numerous.

Distribution: Like the foregoing. Seems to be an oceanic form. Very rare on the west coast of Norway 1898.

P. dictyon (JÖRG.) OSTENF.

OSTENF. l. c. *Pterosphæra dictyon* JÖRG. l. c. As a rule the most frequent form, though often occurring in smaller quantities than the foregoing one.

Distribution: Like the foregoing species, but perhaps rather a neritic form. Frequent on the west coast of Norway, very rare round the Faeroe Islands.

IV. Halosphæraceae.

Halosphæra *viridis* SCHMITZ.

Incl. *H. minor* OSTENF.

In his last work GRAN (L. 70, p. 12—16) has subjected this species to a thorough, comprehensive treatment. I agree, on the whole, with his conclusions, as they — as far as I am able to judge — correspond very well to my own observations. I am also on account of his statements convinced that the large, inner body previously referred to by me (L. 91, p. 46) and which I with some doubt took to be the nucleus, is only an accidental formation, caused by imperfect preservation and treatment (plasmolysis).

Unfortunately, I have not later had any opportunity of examining the moving spores, as the large quantities of *Halosphæra* which were met with near Bergen in 1898 have not since reappeared (as far as I know).

Common, often in quantities, scarce during the spring diatom inflow, especially in 1899.

Distribution: Temperate and tropical oceanic species, widely distributed in the warmer part of the Atlantic and especially (cfr. GRAN l. c.) in the eastern part of the Gulf Stream from the Faeroe-Shetland channel to the far north of Norway and right up to Bären Eiland.

According to CLEVE also west of America, in the Mediterranean and the Indian Ocean.

V. Flagellata.

Phaeocystis *Poucheti* (HAR.) LAGERH.

Only noticed during the diatom inflow, then often in large quantities, although very variable with regard to frequency.

Distribution: Arctic, oceanic (?) and boreal, neritic species, which developes in masses in the mixing-belt between the arctic waters and those of the Atlantic.

Known from Greenland, Iceland, the Faeroe Islands (very frequent during a few months of the year), the North Sea, (numerous in the English Channel in May 1903), Skagerack and Cattegat. On the west coast of Norway in large masses in the months of March—May 1898.

VI. Silicoflagellata.

Gymnaster *pentasterias* (EHRB.) SCHÜTT.

Is this really a dinoflagellate as SCHÜTT means? Occurs fairly often in bottom samples and certainly is due to a plankton form. Also occasionally found in slides from plankton preparations; but

as this organism is so minute, it cannot be expected that it should be retained by the net.

I have never succeeded in seing anything but the siliceous skeleton, notwithstanding that the species on our west coast does not seem to be so very rare.

Distribution: Very imperfectly known. CL. L. 40, p. 250 mentions it from two places near the American coast.

Distephanus ***speculum*** (EHRB.) STÖHR.

Generally speaking, rare and only singly; more frequent, occasionally numerous, during the diatom inflow in spring.

Is so small that it easily goes through the net. Its comparative frequent occurrence during the diatom inflow may be partly caused by its being retained by the diatom masses, but at any rate plainly proves that at this period, it is of frequent occurrence in the plankton.

Distribution: Judging from its distribution, it appears to be partly of southern origin, coming rather sparsely (?) to the north Atlantic as a southern oceanic species, partly too of northern origin, coming from the northern or arctic coasts. According to CLEVE, distributed over the temperate northern Atlantic; also known from the English Channel (February and May 1903, occasionally numerous), the North Sea, Skagerack, the Baltic, the west coast of Norway, the sea between Norway and Jan Mayen (in arctic waters, frequent, cfr. JÖRGENSEN L. 92, p. 36), Greenland, Jan Mayen and the sea towards Spitzbergen.

Dictyocha ***fibula*** EHRB.

CLEVE (L. 40, p. 154) considers it to be doubtful whether this genus belongs to the *Silicoflagellata* or to the *Radiolaria.*

Rare and scarce. Occurs mostly in deep water samples.

Distribution: Temperate oceanic form. Occurs in the Atlantic, The English Channel, the North Sea, Skagerack, Cattegat, the Baltic and the west coast of Norway, everywhere in small numbers.

VII. Radiolaria.

VII a. Spumellaria.

The small number of species which have been observed all belong to the deep water fauna, and usually occur rarely and sparsely. They all appear to be confined to the warmer, salter Alantic waters, and are perhaps all of them temperate oceanic. As a rule, they are only found at places on the outer coast near the sea, single specimens, however, have been found farther in at deep places in the fiords, and these have probably been brought in by the water from the sea.

During the period of the spring diatom inflow, they appear to be absent except in the inner fiord depths, where they may still be found in a few scattered specimens.

Concerning the distribution cfr. farther below under *Nassellaria.*

Key to the genera of Spumellaria.

Spherical shells, with (about) 6 radial main spines in pairs perpendicular on each other .... *Hexacontium.*
(Spongy outer shell which lengthens out as pyramidal scaffolds along the main spines ..... *Rhizoplegma boreale*).

Spherical shells, with several (more than 6) main spines.
3 spherical shells, with broad 3-edged main spines and similar or smaller simple-byspines on the outer shell .. *Echinomma.*
3 spherical shells, with narrow branching byspines on the outer shell .... *Drymyomma elegans.*
4 spherical shells, with delicate outer shell, which is pierced by broad 3-edged main spines and similar or smaller byspines from the next one..... *Chromyechinus borealis.*
Spongy outer shell, which lengthens out along the main spines as interwoven pyramids.... *Rhizoplegma boreale.*

Circular discs, with porous plates above and below .... *Stylodictya.*
Biconvex, spongy lens................. *Spongodiscus favus.*
Outer shell imperfectly closed, with concentric belts and large openings; inside, a double inner shell .... *Phorticium pylonium.*
Outer shell with broad porous plates, which coil themselves into a double spiral round an inner shell; numerous, long, narrow, subulate spines..................... *Larcospira minor.*
Shell of irregular construction with strong, long protruding radial main spines (about 12)......................... *Streblacantha circumtexta.*

1. Cubosphærida HCK.

Very sparsely represented (unless one includes *Rhizoplegma boreale*).

Hexacontium ***enthacantum*** JÖRG. and ***H. pachydermum*** JÖRG.

JÖRGENSEN L. 91, p. 52--54, pl. II, f. 14.

These species, which I at first thought very different, agree so remarkably in some respects, that now I consider it by no means unlikely that *H. enthacanthum* is a young state of *H. pachydermum.* The points of agreement are chiefly in the second shell and in all probability also in the inner one, which is, however, more difficult to examine carefully, as it cannot be seen well unless the outer shells are removed. It is however difficult to obtain this without destroying the inner shell.

The points of disagreement are in the outer ball and are so evident in most instances that it will hardly be recommendable, at any rate at present, to consider the two species as identical. The outermost shell does, nevertheless, appear to vary considerably, both in diameter, the thickness of its wall and its pores, while the middle one varies remarkably little.

I have in exceptional cases found specimens of *H. enthacanthum*, where there were signs of byspines on the outermost shell (they are easily broken off), but have however, never met with any instance of doubt as to whether a given specimen was *H. enthacanthum* or *H. pachydermum*, when only the outer shell was present.

Whether there may possibly be several species or not, I have not been able to decide, as both those above mentioned occur too

rarely in my material. Yet, I have the impression that it is only a question of different forms, not of different species.

When the outside shell is wanting — I look upon such forms as young specimens — I am, however, quite unable, at present, at any rate, to decide whether the specimen belongs to the one or the other of the species above mentioned. (Cfr. pl. VIII, f. 32, a, b).

H. enthacanthum Jörg.

(Pl. VIII, f. 30).

I will only add a few remarks to the detailed description given l. c. (Jörgensen L. 91, p. 52).

This species differs from the following in having a delicate outer shell with comparatively narrow walls between the pores and no byspines.

As in the following species, the pores on the outer shell are different in size, from 6—10 μ, most of them being 8 μ, although they are not strikingly unlike.

The pores of the middle shell in both species are also alike, there is a slight variation in the size of them on the same shell, they average 4—5 μ (seldom as little as 3 or as much as 7). The pores on the two outer shells are about equal in number on the radius. But the inmost shell differs considerably in this respect, the pores here being comparatively much larger and consequently much fewer in number.

On young specimens, where only the two inner shells are developed, one may often see transverse processus on the radial spines where the outer shell is found later on, these processus forming the intermediate walls of those pores in the outer shell which are situated nearest to the main spines. On still younger specimens, however, these processus are also wanting.

Such forms (cfr. pl. VIII, f. 32) may easily be mistaken for species of the genus *Hexalonche*. If one considers the coincidence in dimensions and construction of the inner shells of *Hexacontium enthacanthum* and *H. pachydermum*, it would, however, seem most reasonable to look upon them as being forms of these species.

The outer shell varies in its development from very thin to moderately thick. The pores on the thicker shells seem to be rounder and to have wider walls, which are more plainly widened out in the corners.

I have very rarely seen specimens with a trace of byspines (conically heightened parts) in the corners between the pores. These traces of byspines appear, however, to denote that the limit in the direction of *H. pachydermum* is not certain. The common name ought in this case to be *H. pachydermum*, which would then represent the grown form.

The number of the main spines is usually 6, and sometimes 7, but very seldom more. These spines are usually about equal in breadth inside as well as outside the outer ball.

Ocean forms, of which I have seen a few, seem to diverge somewhat (both in this and the following species). The specimen illustrated pl. VIII f. 30 for instance, had a rather strong outer shell with main spines, which, as is the case with *H. pachydermum*, were considerably narrower inside the shell than outside. The inmost shell too was more solid than usual, and had comparatively more pores and with stronger walls (cfr. fig. 30 b.).

The dimensions of outer and middle shells on 7 individuals (the 6 from the west coast of Norway):

Outer shell	wanting	wanting	wanting	62 μ	78	73	90
Middle shell	34	33	32	32	33	34	34

Thus it will be seen that the diameter of the middle shell varies remarkably little, while that of the outer one varies considerably.

Rare, in deep water samples, always in small numbers.

Distribution: Temperate oceanic form, which with us is only found in deep water, especially at a depth of 300 m. or more. Somewhat more frequent on the west coast of Norway. Also known from scattered spots in the sea beyond the coast of Norway and from the Faeroe and Shetland Isles northwards.

H. pachydermum Jörg.

(Pl. VIII, f. 31).

The byspines on the outer shell vary considerably in length. They are found in all corners where the pores meet, so that each pore is surrounded by several byspines (generally 5 or 6).

The pores on the outer shell are more or less round, the intermediate walls being on the whole broader than in the preceding species, answering to the development of the outer shell which is altogether stronger in this species. This shell is especially thick.

The length of the main spines varies considerably.

The byspines on the middle shell are little conspicuous, and may be easily overlooked (as in the case of the preceding species).

The innermost shell is here seen less clearly than in *H. enthacanthum*, unless the thick outer shell be removed. One may, therefore, easily mistake this species for a *Hexalonche*, by overlooking the inside ball. I have, however, repeatedly convinced myself on breaking the outer shells, that it is always present. Its construction is the same as in the preceding species.

No important difference in dimensions between this species and the preceding one seems to be found, and this is a very important factor when considering the question as to whether these supposed species are specifically different, or only constitute different forms of one and the same species. Here too the outer shell varies in size, but the middle and inmost ones are remarkably uniform in this respect and resemble those of *H. enthacanthum*.

The ocean forms, however, appear to diverge essentially. I have not had an opportunity, though, of studying them more thoroughly in richer material, so that I cannot yet give a definite opinion as to the probability of separating new species. This, however, does not seem unlikely.

For such a strongly developed ocean form from the sea beyond Söndmöre (in February 1901, S/S Michael Sars, a sample kindly given me by Dr. Gran) was found:

Strong, long main spines (most of them broken off). Numerous byspines (4—6 round each pore), long, needle shaped, 40 μ long (nearly 4/5 of the radius of the outer shell). Outer shell very thickwalled (6—7 μ thick), pores almost even, ± 8 μ, very broadwalled, round, a little broader than the walls. 7 main spines, much narower between the outer shells than outside the outmost one. The diameter of the three balls 108 μ, 39, 19.

Occurred like the preceding species rather rarely and sparsely in deep water samples, though perhaps somewhat more frequently. As a rule it is found in deep water samples from such outer pla-

ces where the sea water has easy access. During the spring diatom inflow, it seems generally to be absent, except at greater depths in the inner fiords, where scattered specimens occur. This also seems to be the case, on the whole, with regard to the other *Spumellaria*.

Distribution: Chiefly the same as in the preceding species, often together with it.

VII A. 2. Astrosphærida Hck.

Echinomma *leptodermum* Jörg.
(Pl. VIII, f. 33).

Jörgensen L. 91, p. 57.

This species is at once recognized by having more numerous and shorter radial spines, larger and more uneven pores on its outside shell, as well as by its irregular (deformed) middle shell. It is also in other respects very different from the two preceding species.

The outer ball thinwalled (the walls broader than they are thick). The pores polygonally roundish oval, very uneven in size, 7—25 μ, with intermediate walls (2—4 μ broad), which are much broader towards the corners (lumen rounded off).

The middle shell moderately thick (the intermediate walls being as thick as they are wide, about $1^1/_2$ μ), rather angular and irregular, a little larger than in *Hexacontium enthacanthum;* diameter about 40 μ. The pores somewhat uneven, roundish, 4—7 μ. The intermediate walls solid, not particularly broader in the corners.

It is difficult to see the inmost shell, which possesses solid beams (about equal in thickness to those of the middle shell), but rather few polygonal, mostly pentagonal or hexagonal pores, about 8 μ. The diameter of the inmost shell about 15 μ (or a little more).

About 15 main spines, about equally broad inside as outside of the outmost shell, not long. They seldom protrude farther than to a length equal to the distance between the two outer shells, often less, and vary in development. Between the two inner shells, the radial spines are very narrow and in fact hardly wider than the beams of the inmost shell.

The byspines on the outside shell are in appearance like the main spines, but not radially lengthened inwards, with a wide base on the outer shell (like the main spines) and very unevenly developed in size, although generally protruding less than the main spines. Variable in number; although, as a rule, not many, far from being developed in all the corners, only here and there.

The number of the main spines is variable, often only about 10, though oftenest about 15. They are 3-edged as in *Hexacontium pachydermum.*

The nearest relation to this species is, without doubt, *E. trinacrium* Hck., which species, however, to judge from Hæckel's illustration and description (L. 84, p. 441, pl. 24, f. 6—8) is well distinguished by the construction of the inside ball, as well as by several other, less important, characteristics (as the number of the pores and spines).

As in *Hexacontium pachydermum* and *H. enthacanthum*, there are forms without outer shells, but there is generally a trace of these in transverse processus on the main spines. These may, however, also be entirely absent. Such forms, of which one is illustrated on pl. VIII f. 33 c, might equally well be reckoned as belonging to the genus *Actinomma* (without byspines on the third shell), respectively *Haliomma* (with only two shells), if their dimensions and other characteristics were not completely corresponding to the above species. Cfr. Jörgensen l. c. p. 58.

This species also varies a good deal. When the outside shell is thin-walled, the pores and intermediate walls are of a more uneven size. The byspines are in such cases slightly developed or (as yet) wanting.

It is likely that these divergences may be accounted for by a difference in age. A more important difference is the number of main spines, which seems to be able to vary from 10 to 16.

Comparatively frequent, though, like all radiolaria with us, always present in small numbers. It occurs, however, decidedly more frequently and in larger numbers than the two *Hexacontium* species.

Distribution: The same as that of *Hexacontium enthacanthum* and *H. pachydermum.* Frequent also on the west coast of Norway and in the Norwegian Sea.

E. trinacrium Hck.

The forms which I have tabulated under this name are somewhat uncertain. They are distinguished from the foregoing species by a strong, rather thick outer shell, more numerous and stronger byspines, as well as by a different construction of the inmost shell, which is in most respects like the middle one.

There is nevertheless on the one side a considerable agreement with *Chromyechinus borealis,* only that the outside shell (the fourth) is wanting, on the other side a considerable resemblance to younger forms of *Drymyomma elegans,* where the characteristic branched byspines are still wanting or are branchless needles. To this must be added that different forms of *E. leptodermum* may also have rather strong outer shells and more numerous spines.

As a rule, though, the forms of *Chromyechinus borealis* may easily be recognized by the transverse processus on the radial spines, which here, as in *E. leptodermum* and *Hexacontium enthacanthum* suggest the beginnings of the still undeveloped outer shell. The forms of *Drymyomma elegans* have characteristic long slender main spines and narrow byspines. Yet, I am not sure if there be not still another species, most nearly answering to *E. trinacrium*, but with long, narrow principal spines and byspines, the latter always being branchless.

It is difficult to examine the inmost shell. I have not yet succeeded in ascertaining with certainty whether such a firmly constructed inner shell with which *E. trinacrium* is depicted by Haeckel (L. 84, pl. 24, f. 6—8) is also characteristic of *Chromyechinus borealis* and *Drymyomma elegans.* I have, however, seen such a shell.

As I have already suggested in a previous paper (Jörgensen L. 91, p. 57) it is not impossible that what I have called *E. trinacrium* may be certain young forms of *Chromyechinus borealis*, where the above mentioned transverse processus on the radial spines are wanting. On the other hand, it is just as likely that there may be with us another species differing from both *Drymyomma elegans* and *Echinomma trinacrium,* to which the supposed intermediate forms belong. This species would be comparatively frequent on the northern coasts of Norway.

Until this is made evident, it will be best to keep to the species which are always easily recognized, *viz. Echinomma leptodermum, Chromyechinus borealis* and *Drymyomma elegans.*

Occurs in the plankton like the foregoing species.

Drymyomma *elegans* Jörg.
(Pl. VIII, f. 34).

Jörgensen L. 91, p. 58.

This species, when fully developed, is very easily recognized by its branched byspines on the outside shell.

The outside shell is strongly developed, thick walled, diameter ± 85 μ. The pores are roundish with broad intermediate walls, unevenly developed, though not so much so as in *Chromyechinus borealis*, on an average about the same size or perhaps most of them a little smaller.

The two inner shells seem in all important respects to answer to those of the following species, *Chromyechinus borealis*. Still, I must call attention to the fact that I have had very little chance of examining them more thoroughly, as the species occurs so sparsely.

The number of the main spines seems to vary (?) from about 15 up to about 20. The largest are beautifully developed, long, slender and always branchless, a few of the smaller ones seem, on the contrary, occasionally to have a single needle shaped side branch, like the corresponding one in *Chromyechinus borealis*.

Of byspines there are some resembling the main spines, only smaller and especially narrower. From these 3-edged spines there seems to be every transition to numerous narrow needle shaped ones without distinct edges.

Most of the byspines, especially the narrow ones, carry in their upper halves from 1—4 obliquely diverging narrow branches, some of these again carrying a similar, but shorter, side branch.

There seems to be a regular transition from the more delicate radial spines to the more strongly developed, 3-edged and branchless, byspines.

It is, however, as above mentioned, probably not quite certain that the previously mentioned *Echinomma*-forms with long, slender main spines and byspines, should all be included in this species. These forms occur, with us, much more frequently than the fully developed *Drymyomma elegans*.

Rare and scarce, only found at a few places in 1899: Sea off Gaukværö, 19/1, 0—700 m., Senjen, 21/1, 0—130 m., the Vest Fiord, 1/2, 0—200 m., Skroven, 4/2, 350—300 m., the Tys Fiord I, 28/3, 0—700 m.

Distribution: Very rare also on the west coast of Norway, only in deep water. Also known from the Norwegian Ocean off Söndmöre and from the Vest Fiord, Feb. 1901. (Cfr. Gran L. 70, p. 150—151).

Chromyechinus *borealis* (Cl.)
(Pl. VIII, f. 35; pl. IX. fig. 36—37).

Actinomma boreale Cl. L. 30, p. 26, pl. 1, f. 5 c (vix a, b).
Chromyomma boreale (Cl.) Jörg. L. 91, p. 59.

This remarkable species is easily recognized by its four shells, of which the outside one is exceedingly delicate and very differently developed. This outside shell is very often wanting, but there are usually — as before mentioned — indications of it in the transverse processus on the radial spines.

On the outside shell there are — but only rarely in the material which I have examined — narrow byspines, few in number, which most often form more or less obliquely (not straightly radially) protruding extensions of the walls between the pores. They may also sometimes be seen as bristle-shaped branches extending obliquely out from the main spines. They are thus not radial byspines, although they have undoubtedly the same biological value as these.

On account of these spines, it will, I think, be most correct to enter the species as a *Chromyechinus*, especially as, on the shell next to the outside one, there are both main spines and byspines (both having the same appearrance) in the same sense as in *Echinomma trinacrium*.

It is quite remarkable to what variations this species is subjected, even in the matter of dimensions. I have found the following dimensions on the three outer shells, for 6 specimens:

Outside shell	96 μ	114	100	118	121	116
Next to the outside one	77	83	83	83	89	86
Next to the inside one..	34	35	37	36	40	36

It will be seen that the dimensions of the shell next to the inmost one differ only a little from the corresponding ones in *Hexacontium enthacanthum*, *H. pachydermum* and *Echinomma leptodermum* (as well as in *E. trinacrium* and *Drymyomma elegans*). The third shell too corresponds, on the whole, well to the third one in the species mentioned.

This is a very interesting phenomenon, seeming to indicate a development of all these forms from a common, comparatively young, principal form, the balls being probably formed centrifugally, at any rate, after the second. It may, on the other hand, perhaps be the case that the less developed inmost shell is formed later, centripetally. I mean that I have seen traces which lead me to conclude that its connection with the second ball is not merely a prolongation of the radial spines.

In this species, it seems to be possible to distinguish between two series of forms, which in their extreme forms are so different that one would not hesitate to class them as distinct species, if there were not so many variations within each series that as yet it does not seem able to fix any certain limit. It is not unlikely that really here exist several closely allied species.

The one series of forms (cfr. pl. VIII, f. 35) has shorter broader spines, not very different in development, on the whole very similar to those of *Echinomma trinacrium* Hck. The outer shell is very delicate, closed.

The other series has longer, more slender spines, varying considerably in size. The outer shell is of firmer construction, and always seems to be open on one side (not complete). Here the radial spines and the byspines are particularly long, and this circumstance together with the large hole in the outer shell causes a foreign appearance, something like in certain species belonging to the *Nassellaria* and *Phaeodaria* groups.

On strongly developed forms of this second series, there are also sometimes seen „false“ byspines, as described above, at any rate in the form of side branches on the largest radial spines on the open side of the outer shell.

On those forms too where the outer ball is closed, there often seems, however, to be a comparatively strong development of the spines on one side of the shell.

The pores on the outside shell vary considerably in size and shape, both on one and the same individual and on different ones. They range from quite tiny, circular shaped, to large, longish holes.

Also the width of the intermediate walls between the pores is very variable; on the other hand, their thickness is never great.

The shell next to the outside one is always strong, thick-walled, with very uneven pores, roundish and oblong, most of them being 10—16 μ, although sometimes considerably smaller or larger.

The ball next to the inside one answers in all important respects to the corresponding one in *Echinomma leptodermum.*

The inmost shell is difficult to see. Its diameter is abouth 16 μ. I have not succeeded in getting it out uninjured when breaking the outer balls, so that I cannot give a good drawing of it.

Cleve's *Actinomma borealis* is undoubtedly the same as this species. He seems, however, to go too far in his opinion of the variations in the radiolaria, as will be seen on reference to his illustrations fig.s a and b (l. c., pl. 1, f. 5 a and 5 b). He looks upon them as young forms of the same species which he illustrates in fig. 5 c. I think that f. 5 b = *Echinomma leptodermum*, f. 5 a is probably the same species (too few main spines depicted on the illustration?) without a developed outer shell.

Rather frequent, both on the north and west coast, though rarely at all somewhat numerous. As is the case with the other *Spumellaria* with us only found in deep water.

Distribution: The same as that of *Echinomma leptodermum.* Found by Cleve in deep water samples from the sea west and south of Spitzbergen (L. 30, p. 26). Also known from a few places in the North Ocean as well as (cfr. Cleve L. 40, p. 136) a couple on the American side of the Atlantic, near the surface.

Rhizoplegma *boreale* (Cl.) Jörg.

(Pl. IX. f. 38, pl. X, f. 38 e—f.).

Hexadoras borealis Cl. L. 30, p. 30, pl. 2, f. 4, a, b, c.

Rhizoplegma boreale (Cl.) Jörg. L. 91, p. 61.

Easily recognized by the characteristic interwoven pyramids around the main spines (pl. IX, f. 38 b).

Haeckel depicts similar pyramids for *Rhizoplegma lychnosphæra* (L 86, pl. 11, f. 5).

The inside shell is irregular, not quite round; sometimes resembling a cube in shape, sometimes it is more like an octahedron. The pores are uneven, irregular, polygonal, averaging about 10 μ.

The intermediate walls between the pores are not broad, differently developed, but never having the distinct broader corners which correspond to the rounded lumen of the pore. A few small, short, needle-shaped byspines are found here and there on the beams, but not regularly in the corners.

The main spines are long and strong, often 8 in number (according to Haeckel's system answering to an inner cube), although also often only 6 (answering to an octahedron) or 7. A larger number may sometimes be found (cfr. pl. X, f. 38, e—f.) The main spines have 3 strongly developed edges which narrow off toowards both ends. On these edges there are transverse branches diverging at right angles and these, together with the corresponding ones on the other edges of the same spine, form a very variable number of verticils of threes.

The spongy, loose and very irregularly constructed network, which forms the outer shell, arises from the lowest 2—3 verticils on the main spines, but has the appearance of being lengthened out a good way up along the radial spines, on account of the thin connecting beams, which unite the different verticils parallel to the direction of the spine (fig. 38, a, b).

Also on the outside of the outer spongy shell (network), there are some few scattered short and fine, needle-shaped byspines.

The ocean forms seem generally to have 6 radial spines.

There seems to be a slight difference between the regular forms which have 6 radial spines, and those which are more frequently found in the coast water and which have about 8. The former seem to have a smaller inner shell with distinct byspines. I have, however, not discovered any definite difference so as to make it necessary to divide them into two or more species.

Young forms (cfr. pl. X, f. 38, e—f. and Cl. l. c. pl. 2, f. 4 a) are rather unrecognizable, as both the interwoven pyramids and the spongy outer shell are absent.

The construction of this species resembles greatly that of *Rhizoplegma radicatum* Hck. and *R. lychnosphæra* Hck. The inner, fine, transverse branches on the radial spines in the space between the outer, spongy shell and the inner shell are, however, wanting. These transverse branches are by Haeckel the characteristic of the subgenus *Rhizoplegmidium.*

According to Haeckel's system, it might perhaps be a question as to whether or not our species should be classed as belonging to the genus *Lychnosphæra*, because of the byspines on the inner shell. As these, however, are small and few in number, and perhaps not even always present, this would not be recommendable, and still more so as such a distinction between the genera seems to be unnatural.

Haeckel's genus *Hexadoras* has radial spines without side branches, for which reason I still mean that the above species finds a more natural place among the closely allied forms of the genus *Rhizoplegma*, notwithstanding that there undoubtedly often occur forms with 6 main spines.

Belongs to the most common radiolaria with us and is not rare in deep water samples, although never numerous.

Distribution: On the west coast of Norway rather frequent, although rare in fully developed condition. Known from the sea west and south of Spitzbergen (Cl. L. 30, p. 30) and from a few places in the Norwegian Ocean.

VII A. 3. **Porodiscida** Hck.

Stylodictya Ehrb., Hck.

Species of this genus seem only to occur quite exceptionally with us. I have only seen a very few individuals, which appear, however, to belong to species hitherto unknown. All have more or less distinct circular, inner rings, not spiral-shaped, and belong, therefore, to Haeckel's subgenus *Stylodictyon.*

In deciding a species, it is of great importance to examine the shape of the disc in side view.

I have only included in my list those species in which I am acquainted with this shape.

S. tenuispina Jörg. n. sp.

(Pl. X, f. 39).

Shape of the shell in side view: Almost linear, though somewhat thicker in the middle and slightly narrowed towards the ends

which are rounded off. A small portion of the central part of the shell is strongly convex, forming a protruding ball shaped cap on either side (pl. X, f. 39 c).

System of Rings: From an inner little spherical shell 4 radial rods extend in the form of a cross to the 1st ring, which forms an irregular quadrangle with rounded corners. The radial rods pass through the middle of the sides. Beyond this ring there are, on the specimen illustrated, 6—7 rings, each joined to the one next outside by a continually increasing number of radial rods. It is likely that the number of the rings increases as time goes on. The inner rings are still somewhat angular, the outer, however, more regular. The outmost ones seem, however, again to show irregularity, which perhaps, disappears with age.

Pores: The strongly convex central part, which corresponds fairly well to the 1st ring, has unusually large, roundish, hexagonal pores, which are much broader than the separating walls. The rest of the pores are exceptionally small and uneven in size, most of them being narrower than the intermediate spaces, or of the same width as these, very little larger outwards, 2—3 on the space between two rings.

Radial spines: Around the disc (in the imperfectly developed individual, cfr. the illustration) a few very narrow, needle-shaped radial spines protrude, apparently in no definite order. Numerous radial rods are to be found between the outer rings; some go through two or more, others again only connecting two rings.

Byspines: Very small, almost punctiform, short byspines, largest and closest together on the convex central part, the others being only scattered over the disc.

Dimensions: Diameter of 1st ring 30 μ, of 2nd 42, of 3rd 59, of 4th 78, of 5th 98, of 6th 120, of 7th 144, 8th ring irregular and as yet incomplete. The rings are thus somewhat broader ontwards. The large pores on the central part 5—6 μ, the small ones only $1^1/_2$—3—4 μ. The few piercing radial spines only protrude as far as a distance equal to the breadth of the rings. The disc is 37 μ thick at the convex central part, outside this 30 μ, only about half as thick at the margin.

The specimen which is illustrated seems to me to suggest that the few piercing radial spines are in reality radial rods which penetrate several rings, similarly to those which are seen here and there farther in between the rings. In this case, it is hardly correct to consider them as the radial spines characteristic of the genus *Stylodictya.* The above species might just as well, for that matter, be classed as belonging to the genus *Porodiscus* (without marginal spines); but as one cannot be sure whether there may not be radial spines on the outside ring in the fully developed individual, I have retained the species under the genus *Stylodictya*, where it would at once be placed after a less critical examination. It is certainly also closely related to the following species.

In structure it is very like *Porodiscus orbiculatus* Hck. (L. 80, p. 492, pl. 29, f. 1), which, however, wants the very characteristic, coarsely porous, central part. This has the appearance of a spherical shell with a diameter greater than the breadth of the disc, with a smaller sphere in the middle (this sphere is the innermost shell) and with equatorial rings outside.

Only twice noticed in 1899: In the sea off Gaukværö, $^{19}/_1$, 0—700 m.; in the sea off Röst, $^{22}/_3$, 0—900 m. This makes it very probable that it is an oceanic, deep water species, which only exceptionally comes to our coasts.

S. validispina Jörg. n. sp.
(Pl. X, f. 40).

The structure is, on the whole, the same as in the foregoing species. The strange, peculiar, strongly convex central part is, however, wanting (the disc is homogeneous) and the margin is furnished with numerous strong spines which are almost regularly distributed.

Shape of the shell in side view: Broadly linear (the disc is of almost even thickness) but little narrower at the margin than in the middle, with sharp or obtuse corners, not clearly rounded off at the ends, but almost square. There are short spines scattered on the central part.

The system of rings: From the innermost little shell 4 radial rods extend in the shape of a cross to the first ring, as in the preceding species. The ring itself is also here an irregular quadrangle with rounded corners. Outside this ring, there are three others, connected to each other by radial rods whose number increases outwards. In the prolongation of the 4 primary radial rods (from the inmost shell) may be seen, more or less clearly, some similar ones which are rather crookedly placed, and these conjoin to form 4, more or less definite, zigzag rods, which go through the whole system of rings. On the outside ring there are numerous (21) equatorial, narrowly conical, marginal spines.

Pores: The pores in the centre are very small, punctiform, very scattered with wide intermediate spaces, gradually larger outwards, on the two outer rings about 2 on the space between the rings, uneven in size, up to 4 μ or a little larger. Between the pores on the central part very small, punctiform byspines are scattered, which may easily be overlooked.

Radial spines: Numerous, narrowly conical (subulate), strong radial spines of different lengths, the longest being little more than $^1/_2$ of the radius of the disc. Some project out from the ring next to the outside one, several too from the one next to the inmost one, and yet a few from the innermost one.

Byspines: A few scattered ones, very short and very small, needle shaped, extend from the central part of the disc.

Dimensions: The diameter of the inner shell 14 μ, of the first ring 34, of the second 60, of the third 84, of the fourth 102. In thickness 24 μ.

The specimen illustrated appears to be almost fully developed. Probably only the small portion of the outer ring which is not seen in the illustration, is all that is wanting.

This species exhibits a certain amount of agreement with *S. stellata* Bail. (L. 9, p. 6, pl. 1, f. 20), which has, however, fewer and broader spines, and also differs in other respects.

Only once found: Sea off Röst, $^{22}/_3$ 1899, 0—900 m. (together with the preceding and the following species).

S. aculeata Jörg. n. sp.
(Pl. X, f. 41).

This species corresponds well in structure to the foregoing one, but differs in a marked degree with regard to its radial spines, which are particularly numerous, and are more irregularly placed, not all lying at the same level, that of the disc, but pointing obliquely beyond and beneath it.

Shape of the shell in side view: Broadly linear, with rounded corners and ends. From the centre to near the margin, there are small scattered punctiform byspines.

System of rings: On the whole like the preceding, only the rings are more irregular in shape and width.

Outside the fourth ring there seems to be traceable the beginning of a 5th which is as yet not formed.

Pores: On the whole like those of the preceding. Very large pores here and there on the edge of the disc, which would probably have formed several smaller ones later on. The byspines are very scattered, fewer in number than in the preceding species, but distributed over a larger part of the disc.

Radial spines: The rings are united similarly to those in the preceding species, but the number of radial spines around the disc is larger, more than 30. The spines are narrower and more irregularly developed, some being a little bent, turned outwards and obliquely upwards, not all at the same level, equatorial, but distributed over the broad, rounded margin of the disc. The length of the spines is about the same as in the preceding species.

Byspines: Very similar to those of the preceding species, but more scattered and distributed over the whole of the disc nearly out to the margin.

Dimensions: The diameter of the inmost shell 12 μ, of the first ring about 38, of the second 54, of the third 85, of the fourth 110. Pores uneven, most of them being 2—4 μ. The spines protrude as much as to 30 μ. The disc is 28 μ in thickness.

This form appears to differ considerably from the other species on account of the irregularly placed marginal spines. The specimen illustrated is probably not quite fully developed.

Note. *Stylodictya aspera* JÖRG. (L. 91, p. 61) is a fourth species.

VII A. 4. Spongodiscida HCK.

Spongodiscus *favus* EHRB.

EHRB. L. 53, p. 301. HCK. L. 86, p. 577.

A species, which on the whole corresponds fairly well to the description given by HAECKEL of this species, was twice found together with *Stylodictya tenuispina* (cfr. under this heading).

No inner rings were seen. The disc was shaped like a little thick, biconvex, lens. Towards the margin there were fine radial spines here and there, some of these were a little protruding; but the disc did not appear here to be fully developed. The pores towards the margin much larger than in the middle. Diameter 180 μ.

Distribution: According to HAECKEL, the North Atlantic, Greenland, Faeröe Channel (Murray), surface.

VII A. 5—7. Irregular Spumellaria.

The three forms mentioned below of irregular Spumellaria are difficult to trace and explain, and have given me a great deal of work and taken a lot of time. For each form I have briefly mentioned the results I at last arrived at; but there is still a good deal of work left before a full light with regard to their structure can be claimed.

VII A. 5. Pylonida HCK.

Phorticium *pylonium* (HCK.?) CL.

(Pl. X, f. 42, a—d; pl. XI, f. 42, e—f., f. 43—45).

CL. L. 30, p. 31, pl. 3, f. 2 a, b, c. HCK. L. 86, p. 709, pl. 49, f. 10? *Tetrapylonium Clevei* JÖRG. L. 91, p. 64.

This species was first classed as *Phorticium pylonium* HCK. by CLEVE, l. c. Judging from his illustrations, the innermost shell was not noticed, which would allow of the species being classed as *Phorticium pylonium,* a form which is probably little known.

As I, however, found such an innermost shell, and apparently 3 systems of girdles, I concluded that I should refer the species to the genus *Tetrapylonium*, as *T. Clevei* JÖRG. n. nomen. CLEVE has, in a later work accepted this name and remarks that the species is not identical to *Phorticium pylonium* HCK., probably because he has also seen the innermost shell.

After much fruitless labour, I at last succeeded — as far as I can see — in getting a glear idea, in all important points, of the structure of this interesting species, and I have found it to be as described below. As will be seen, it is quite different from that of the genus *Tetrapylonium* and — as far as I can see — of all the others mentioned by HAECKEL. This would necessitate a new genus, if there were not a possibility that the species is, after all, identical to HAECKEL's *Phorticium pylonium.*

The genus *Phorticium* is too vaguely described by HAECKEL to be recognized, either after the description he gives or his illustration. As, however, HAECKEL speaks of *P. pylonium* as a very frequent species of very varying appearance, there may be, as already suggested, a possibility of my species, after all, being found to be the *P. pylonium.*

The structure is principally as follows (cfr. pl. X, f. 42*): On the most perfectly developed specimens there is on the very outside a largest, lateral girdle, a broad oval or almost a rectangle in shape, with rounded corners. (Cf. CL. l. c. fig. 2 a). Generally, only the sides of this girdle, nearest to the transverse girdle, are present. This outmost lateral girdle is seen in profile in a dorsal view, looking perpendicularly towards its level (when the belt itself it seen from the narrow side). CLEVE's fig. 2 a gives such a dorsal view.

Right in the middle of this girdle and placed perpendicularly on it, dividing it into two equal parts, we find a second girdle developed where it must be shortest, namely, on a plane parallel to the shortest side of the rectangle. This is the transverse girdle (the designations correspond to HAECKEL's). It is seen from the front in the dorsal figure (pl. X, f. 42, a, b) and from above in the apical one (pl. X, f. 42 c, d). In the lateral figure (pl. XI, f. 42, e, f) the sidepieces of the girdle are seen from the front; they coincide with the corresponding parts of the lateral girdle.

Across this girdle a new one is similarly developed at the shortest distance, perpendicular to both the former ones. This is the sagittal girdle. It is seen in profile in the lateral figure (the sagittal section) and from above right against its wide side on the apical one (the transverse section).

Again, perpendicular to this sagittal girdle and to the preceding one, and also where the distance is least, yet another girdle is similarly developed, thus forming an inner lateral one parallel to the outermost one, which is the largest.

In this way the girdles continue inwards, until there are 3 lateral, 3 transverse and 3 sagittal ones. In the dorsal view (the lateral section) there will, therefore, be seen 2 concentric, somewhat oval, inner shells encircled by a broad cross girdle and a lateral girdle, which is still broader and more or less completely developed and is seen in profile (f. 42 a, b.) In the lateral view (on the sagittal section) will also be seen two inner shells, both oblong-rectangular. The innermost one is connected with the next one, by a more or less clearly discernible girdle, the inner lateral girdle. Inside the innermost one, there are traces of yet another smaller one. Outside the outermost one, will be seen the more or less complete broad lateral girdle (f. 42, e. f.) In the apical view (the transverse section) may also be seen two inner shells, almost square with curved sides. The middle one is joined to the outer transverse girdle by another girdle which is not very broad — the sagittal girdle. Round the figure the transverse girdle is seen in profile (f. 42 c, d; the endpieces of the lateral girdle are here undeveloped).

It must not be understood that the girdles are developed from the outside inwards, in the order in which I have described them. On the contrary, it is probable here too that the formation of the skeleton is centrifugal, the innermost portion, perhaps, excepted.

The most important difference between the structure of this species and that of *Tetrapylonium* Hck. is that in this latter genus (according to Hck.) 3 separate trizonal shells are developed one outside the other. In the form here described, on the other hand, it will be more or less arbitrary to distinguish between several shells on account of the connecting belts which in themselves constitute a clear structural plan.

There is, too, a number of radial spines, which are especially definite and strongly developed in two diagonal planes, and here form 8 protruding spines at the corners, as in *Octopyle octostyle* and several similar forms.

There are also others, apparently irregularly scattered, which support the outside lateral girdle.

Finally, a rather large number of byspines occur on the outer part of the shell, short, needle shaped and with a broader base.

The pores are uneven, somewhat larger on the outer lateral girdle, roundish, oblong and polygonal; with strong separating walls, when they are fully developed. On the transverse girdle, the pores are smaller, roundish, very uneven, with wide separating walls.

The girdles are all rather irregularly developed, not symmetrical. Neither are the radial spines symmetrically placed.

As already mentioned, it cannot be seen from Haeckel's description, what is the actual structure of the genus *Phorticium.* I have, therefore, refrained from proposing any new name, until Haeckel's species *Phorticium pylonium* is more clearly defined.

To the form here described belong also the majority of *Octopyle octostyle* Hck. *f. minor* Jörg. l. c. p. 64. These forms are less developed than *Tetrapylonium Clevei,* but seem, generally speaking, to belong to the same species. To the same forms too, the *Phorticium pylonium* illustrated by Haeckel would appear to belong.

It is, however, quite likely, that at least two species are confused here.

Rather frequent, but always in small numbers and in deep water samples.

Distribution: Not unfrequent on the west coast of Norway, also in deep water samples. Cleve has found it in samples from deep water from the sea west and south of Spitzbergen, as well as in surface samples from the American side of the North Atlantic. Also known from a few places in the Norwegian Ocean.

Haeckel designates *Phorticium pylonium* as cosmopolitan (Mediterranean, Atlantic, Pacific etc. „surface and in various depths".)

VII A. 6. Lithelida. Hck.

Larcospira *minor* (Jörg.)

Lithelius minor Jörg. L. 91, p. 65, pl. 5, f. 24.

This species has a very different appearance, according to the position in which it is seen.

In one position it has an appearance corresponding to the illustration referred to, and which caused me to consider it as a *Lithelius* with a double spiral.

On being rolled under the microscope it has, in another position, the appearance of 3 distinct (concentric) shells, one outside the other, the innermost being somewhat oblong, the other two rounder.

In this last position, an indefinite contour of an inner, smaller shell is seen in the innermost one.

From which one may probably conclude that the innermost of the three shells is double, *Larnacilla*-shaped or trizonal (according to Haeckel's designations). I have not, however, succeeded in seeing this clearly.

Form this shell there extends, on both sides, a transverse girdle, which winds itself into a spiral about the largest axis of the inner shell, the longitudinal or principal axis (after Haeckel). These two spirals give rise to the appearance of a *Lithelius* with a double spiral, when looked at from above (transverse section, after Haeckel apical view).

In a certain, a little oblique, position one gets again a more or less indefinite impression of a single spiral.

In each spiral there is only a little more than one turn.

Pores somewhat uneven, not large.

Numerous, long, narrow, needleshaped radial spines. (Cfr. also Jörgensen l. c.).

One of the most frequent radiolaria in the north, sometimes also rather numerous, especially in ocean samples.

Distribution: Also rather frequent on the west coast. Known too from a few places in the Norwegian Ocean, where it occurs together with southern forms.

Note. What is in one instance in the tables entered as *Lithelius spiralis* Hck. is very uncertain, and it is probably only a form of *Larcospira minor*, which, as already mentioned, in certain positions gives the appearance of a single spiral. The same is the case with regard to *L. spiralis* Jörg. L. 91, p. 66.

VII A. 7. Streblonida Hck.

Streblacantha *circumtexta* (Jörg.)

(Pl. XI and XII, f. 46).

Sorolarcus circumtextus Jörg. L. 91, p. 65.

This is also a very difficult form to define, and I have not yet succeeded in getting a clear insight into its structure. It can, however, not belong to the genus *Sorolarcus* Hck., as I at first thought.

There appear to be about 12 strong radial spines, of the same shape as those of *Phorticium pylonium* Cl., but protruding much further. They are more or less round, not three edged.

The outline of the shell in most positions is a broad oval, in a few, almost round. Some optical sections show inner spirals, then a double spiral as in *Larcospira minor*, other sections show at least 3 shells one outside the other, perhaps with several chambers (only indistinctly seen).

On the smaller and simplerer forms (cfr. Pl. XI, f. 46, c, d; pl. XII, f. 46 k, l), which I have taken to be specimens in an early stage of development, a single central chamber and spiral twists, which appear to form a snail spiral, may be seen.

On the whole it seems to me at present, that this species may best be placed in the genus *Streblacantha* Hck., though it may prove not to belong to this genus either.

The outer shell shows a more or less irregular structure and very uneven pores, from rather small to large ones and large holes. On the outside of larger (more developed) forms there are also more or less well developed byspines, very various as regards length and development, from small subulate ones with a rather wide base, to long, narrow needles. When more developed, these byspines are more or less connected through fine branches to an outer, spongy case immediately outside the outer shell. This spongy case is, however, rarely much developed, and seems then to be confined to — or at any rate most developed at — the one end of the shell. Cfr. also Jörgensen l. c.

Rare, and generally only singly, the small, younger individuals rather more frequent: The Vest Fiord I, $^{13}/_{1}$, 0—180 m.; Henningsvær, $^{17}/_{1}$, 0—180 m.; the sea off Gaukværö, $^{19}/_{1}$, 0—700 m.; Skroven, $^{1}/_{2}$, 0—300 m., $^{4}/_{2}$, 350—300 m., $^{4}/_{4}$, 0—150 m.; The Raftsund, $^{3}/_{2}$, 0—260 m.; The Tys Fiord I, $^{28}/_{3}$, 0—700 m.

VII B. Acantharia.

Of this group there were only exceptionally small forms with skeletons which seemed to be quite in the wrong place and were, on the whole, very imperfectly developed.

Acanthonia echinoides too, which is frequent on the coasts of Norway during the summer, was entirely absent.

I have only entered a peculiar form without any skeleton, which does not seem, up to the present, to have been met with anywhere else.

Radiosphæra n. gen.

I have several times, but only in conserved material, come across an organism which appears to be a skeleton-less radiolaria of the division *Acantharia*. It possesses, namely, the peculiar plasma products which Haeckel calls myophrisca, and which he describes as characteristic of this group.

For this species, I have had to coin a new name and have called the genus *Radiosphæra*.

R. anacanthica Jörg. n. sp.

(Pl. XVII, fig. 105, 106).

Central capsule spherical, filled with numerous small and large balls (alveoli?) the majority, small. Spines and skeleton wanting. Regularly distributed outside the central capsule, there are several bundles of myophrisca, probably 20 in number. They are short, linear, rather glossy, and are about even in size. In every bunch 6—8 of these bodies. These bunches (or bundles) lie in the outer part of the calymma which forms a structureless mass of slime (jelly), which is only visible on being coloured.

The diameter of the central capsule is 65—70 μ.

Rare and scarce, is, however, easily overlooked: $^{24}/_{1}$ 1899, Kvænangen, 0—50 m.; $^{1}/_{3}$ Evenstad I, 0—50 m.; $^{21}/_{3}$ 1900 Balstad I, 0—200 m.; $^{2}/_{4}$ the Skjerstad Fiord IV, 0—300 m. and the Skjerstad Fiord V, 0—420 m.; $^{4}/_{4}$ the Skjerstad Fiord XII, 0—500 m.; $^{6}/_{4}$ the Folden Fiord I, 500—400 m.

From the above, the species would seem to be oceanic, uncertain whether it is temperate or boreal.

VII C. Nassellaria.

Of this division there was a comparatively large number of forms in the plankton examined and also on the west coast of Norway; and, among these, there were a good many which, on account of their slightly developed skeletons, were at a low point of evolution. These proportionately simple forms are very interesting, in as much as they seem to be able to furnish valuable information with regard to the original structural type for the corresponding divisions, as well as with regard to the phylogeny of the whole class.

Haeckel's splendid work on *Radiolaria* (L. 86) is on the whole admirable for its clearness and the ingeniousness with which apparently unimportant details are fitted together to make up a wonderful and consistently worked out system. If it had not been for this immortal work of Haeckel's, the immense material, which the Challenger and other expeditions provided, would have waited long before it could have been made useful to science to any great extent. There may be differences of opinion as to the justification or appropriateness of the genera and families erected by Haeckel; it is impossible, however, not to admire the immense amount of valuable observations which are so plainly and clearly set forth in his extentive work.

As far as *Nassellaria* are concerned, Haeckel's system does not seem to be quite successful; but this division is, as he himself mentions several times, particularly difficult, and can hardly be dealt with satisfactorily in any other way than by starting from the simplest forms. These simple forms are, however, small and inconspicuous and may therefore easily be ignored for the beautiful and wonderful forms of which there are so many illustrations in Haeckel's famous work.

It is just for these simple forms that it seems to be impossible to use Haeckel's classification. After much groping and many fruitless attempts to arrange the Nassellaria, which I have found in my material, according to Haeckel's system, I have at length felt compelled to get out of the difficulty by erecting several new genera.

Unfortunately the Nassellaria in my material — as is the case with Radiolaria on the whole — never occur in any important numbers, but often only singly. I am, however, more and more convinced that certain simple structural conditions, which seem to have been partly overlooked, partly considered to be of little importance by Haeckel, who does not use them in his classification, recur as the ground plan of a large number, probably the majority, if not all, of forms of *Nasellaria*.

Moreover, I have been enabled, by kind assistance from different quarters, to obtain some richer radiolaria samples — most of them, unfortunately, of fossile species —, which, although I have not yet by far been able to work them through, as far as I can see, show that my opinion of the structure of this division of *Nassellaria* is on the whole correct. I hope in the future in a more detailed work to be able to give more exact reasons for my opinion, and try to apply it consistently to the more important genera of *Nassellaria.*

My remark, that Haeckel had to some extent ignored certain primary skeleton parts, which I consider to be the principal type for all the forms which I have examined, may give rise to some misunderstanding. Haeckel several times draws special attention to the „basal tripodium" as a ground plan, from which a large number, perhaps all, of the forms may be developed. This triradial groundplan also lies at the bottom of certain classifications in his system. According to my opinion, there is something wanting here — of which more further on — which is of great importance. Thus I found, quite at the beginning of my work with *Nassellaria* (Jörgensen L. 91) that Claparède's genus *Plagiacantha* was of different structure than Haeckel (and Claparède) had described, and, unfortunately, proved to have the same structure which Haeckel describes as characteristic for other genera (*Plagonidium* Hck., *Plagiocarpa* Hck., *Periplecta* Hck.).

This peculiar structure is, however, not confined to radiolaria belonging to the genera mentioned, but is common to the whole division, with variations in development in different directions (see below).

This circumstance of itself makes it impossible to retain Haeckel's genera in their original definition.

Whoever has tried to use Haeckel's system of classification of *Nassellaria* for other divisions, as, for instance, the large one *Cyrtoidea,* must certainly have found that the genera and divisions of his system are, at any rate in part, unsatisfactory and prove not to be so well limited as to be of practical service. In several instances, certain secondary structural conditions of comparative insignificance are taken to be a basis for division, as also, in not a few cases, accidental and passing stages of development are used as distinctive characteristics. Especially in several of the *Cyrtoidea* in my material there are — and must be according to my opinion — real radial apophyses, which are not found in the corresponding genera according to Haeckel, so that they would have to be classified under quite different divisions in his system.

On this account, I have been obliged to start new genera here too.

It seems to me that taken as a whole, Haeckel's system as regards the *Nassellaria,* — at any rate, large portions thereof — must be entirely reconstructed. It will then be possible to retain a large number of Heackel's genera, but with different definitions.

Haeckel mentions several times that the *Nassellaria* can monophyletically be traced from an original ground form, but that great difficulties are met with when one tries to put this into practice. He states that „the basal tripodium" or a sagittal ring or a cephalis may be looked upon as such a ground form. He seems, however, to consider the tripodium as the most natural starting point, as there are traces of such a tripodium to be met with in the ring species and *Cyrtoidea* („cortinar feet" in *Cortina* and *Cortiniscus,* „cortinar septum" in several *Cyrtoidea).*

This tripodium corresponds best also to my ideas.

As a foundation for the detailed description which follows, I have had to coin various designations which are most easily explained together when giving a comparative treaty of the whole group. Then too, I will explain my ideas with regard to the relation one to another, and the origin, of the genera found in the material under examination.

Phylogeny of the genera mentioned.

As an original ground form, I take one which is similar to *Plagonidium* Hck. (and *Plagiocarpa* Hck.) and which has four spines, extending in twos divergently from the ends of a short central rod. The plane through two of them, the sagittal plane, is perpendicular to the plane through the other two.

With a change of direction, an apical spine, A, and 3 basal ones will soon appear. These basal spines are one of them dorsal, D (fig. I) and two lateral, L_r (right) and L_l (left).

This seems to be a natural form for the skeleton, considering the position of the central capsule. (Cfr. below, concerning the position of balance in the water).

These 4 primary spines are, as stated in my previous paper (L. 91), the same as constantly occur in the *Nassellaria* which I mentioned. There they were called: Der primäre Mittelstachel (= D), der Vorderstachel (= L_l) and der Hinterstachel (= L_r). My reason now for changing the names is that the designations used will continually recur in the special descriptions, which it would not be at all easy to understand unless I gave these spines their special names, so that it was important to choose suitable ones, and such as agree as far as possible with the designations used by Haeckel, whereever these latter could be retained.

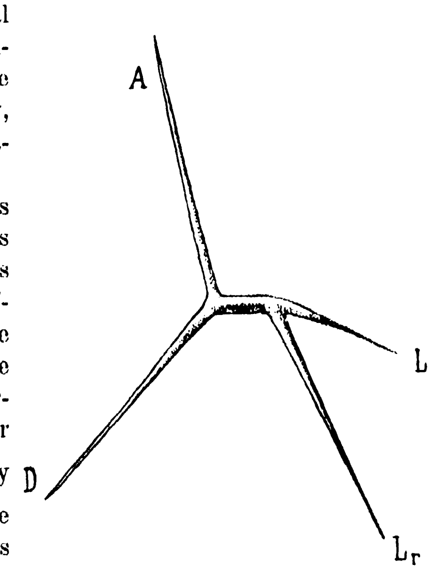


Fig. I. The ground form; lateral view, perspectively. Schematically, as the following figures.

If the skeleton be placed so that the central rod is horizontal and seen from the ventral end, the sagittal plane being vertical and the apical spine directed upwards, then the primary dorsal, basal spine D will be directed backwards and downwards, the apical spine A somewhat backwards and upwards, the left, lateral spine L_l (from the ventral end of the central rod) downwards, forwards and to the left, and the right, lateral spine L_r downwards, forwards and to the right (fig. II and fig. III).

Now there arises a verticil of 3 branches on each main spine, and so we have the *Plagiacantha* type, as it is found in the species *P. arachnoides* Clap. (not the genus *Plagiacantha* Hck.).

The apical spine is here rather small and has (generally?) only two branches.

My reason for considering the apical spine, nevertheless, as belonging to the primary skeleton, is that I have never come across

any form in which it was wanting. Its comparatively weak development, in many cases, may therefore be due to retrogression. At any rate, it would have to be looked upon as a spine which appears at a very early stage of development, so that, in the case in question, it will only be immaterial whether it is considered as being formed at the same time as the 3 basal ones, or as having

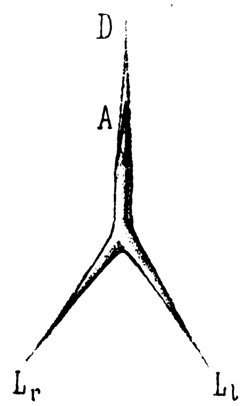


Fig. II. The ground form; apical view.

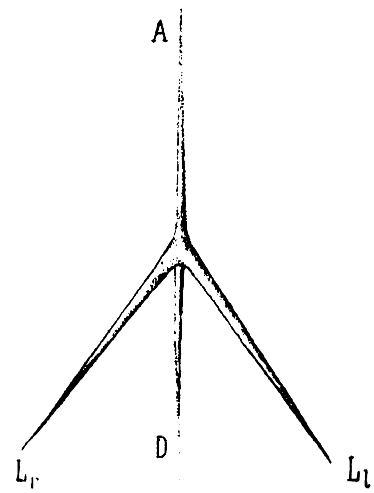


Fig. III. The same; ventral view.

been formed later. In other words, HAECKEL's basal tripodium may be a more original form; but the ground form with 4 spines which I have chosen as a starting point, is the common type for all the forms which I have found.

This primary verticil of branches is found, more or less distinct, in a series of forms, which appear, therefore, to originate, more or less directly, from the *Plagiacantha* type.

There is a peculiarity with regard to the verticil, which plays an important part when examining the skeletons, as it makes it easier to trace the corresponding parts and makes clear the relation between certain forms.

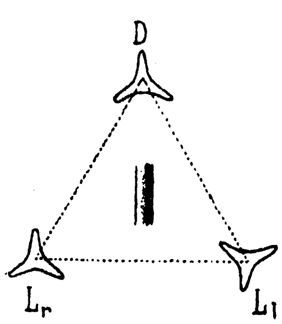


Fig. IV. The Plagiacantha type; transverse section of the basal spines.

The branches of the dorsal spine, D, are placed one dorsally, two ventral-laterally. (Here we only regard the projections of the branches on a plane perpendicular to the direction of the main spines. The actual direction of the branches is determined too by that of the main spines, so that it will be, respectively, dorsally upwards and ventral-laterally downwards.)

On the right lateral spine, the direction is almost corresponding, that is with one branch outwards (away from the central rod, cfr. fig. IV), while the verticil of the left lateral spine is turned so as to take the position as denoted on fig. IV. The edges have also the same position, where they occur, as well as the secondary spines.

In this way, the plasmatic body will be more perfectly protected, than would be the case if all three verticils were in the regular positions.

A development in two directions now takes place. There appears a 5th, important, spine, the ventral sagittal one (in my previous paper, JÖRGENSEN L. 91, designated as „der secundäre Mittelstachel"), and the primary connecting arches appear.

The ventral sagittal spine extends from the common starting point for the two lateral spines (the ventral end of the central rod) and is also basal (directed downwards and forwards). On those skeletons which are less richly developed, it is easy to recognize it as a less strongly developed spine of later origin.

The primary arches are developed between those primary branches of the basal spines which are nearest each other, and are, therefore, three in number: (1) The left lateral arch, B_l, fig. V, between the left branch of the dorsal spine, d_l, and the inner branch, l_{li}, of the left lateral main spine; (2) the ventral arch, B_v, between l_{li} and the left branch, l_{rl}, of the right lateral main spine, and (3) the right, lateral arch, B_r, between the dorsal branch, l_{rd}, of the right lateral main spine and the right branch of the dorsal one, d_r.

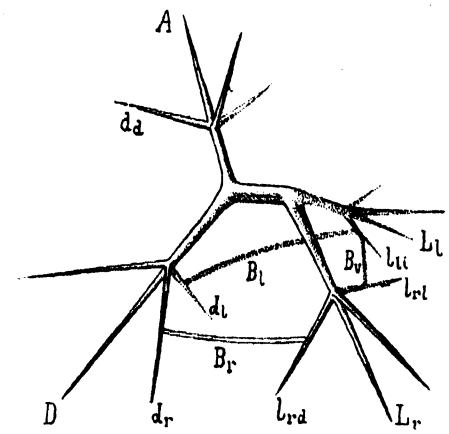


Fig. V. The Plectacantha type; lateral view, perspectively.

Thus, the ventral arch and the left, lateral arch run together to a point on l_{li}, and consequently have a corner in common which is suspended under the left, lateral main spine.

If one now supposes the formation of a more complete network through the addition of secondary meshes and spines, in b a s a l direction, on the sides of the pyramids, one has, in all important respects, *Plectacantha oikiskos*.

On the other hand there is — as above mentioned — development in another direction, the ventral sagittal spine, V, being formed.

A simple form which belongs here is *Campylacantha cladophora*. In its most simple state (young forms?) it consists of the 5 spines D, L_r, L_l, A and V (cfr. fig. VI and fig. VII). The most fully developed individuals seem besides to have two secondary lateral spines, directed lateral-dorsally and basally, l_r and l_l, extending from the base of the apical spine. (These spines, l, are perhaps only

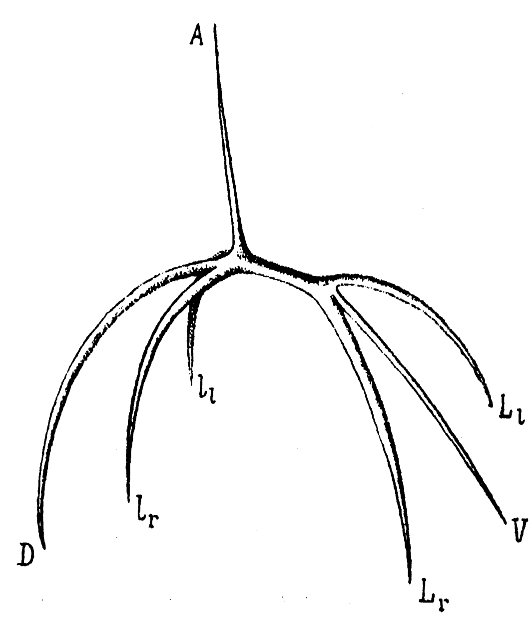


Fig. VI. The Campylacantha type; lateral view, perspectively.

lateral branches of the dorsal main spine, which does not, however, quite correspond to their direction. Cfr. further under *Campylacantha cladophora).*

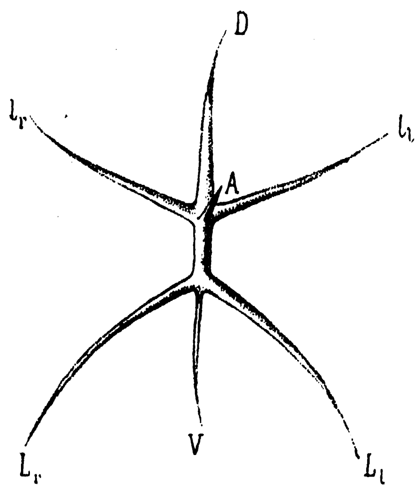


Fig. VII. The Campylacantha type; apical view.

In *Campylacantha,* the primary verticil of branches is wanting. Instead of this, secondary branches (spines) are developed on the 3 edges of the main spines. It seems, therefore, most natural to derive *Campylacantha* from the common ground form, as a parallel form to *Plagiacantha.* It is, however, also possible that the verticil of branches is transformed into the scattered, strong spines on the edges, as this primary verticil appears to occur on the apical spine (?).

The two basal sagittal spines, D and V, are in *Campylacantha* strongly bent towards each other. Let us suppose that these two spines unite at the points, and we should have a sagittal ring.

It would be interesting if the ring forms *(Stephoidea* HCK.) as a whole could be derived in a similar way; but I am as yet unable to judge if this be so, as my personal acquaintance with these forms is too deficient. In the material under examination, only one of these forms occurred, *Dictyocircus clathratus,* and even that was very sparsely represented. It seems, however, to me that this form most naturally may be derived in the manner mentioned. Such a derivation seems to be natural for the division *Semantida* HCK. I think, however, that the whole division *Stephoidea* HCK. requires a thorough revision.

By help of the secondary lateral spines l, (cfr. fig. VI and fig. VII) it seems that *Dictyocircus clathratus* may be quite naturally derived from *Campylacantha cladophora.* (Cfr. further under *Dictyocircus).* In this way too the long, protruding free spine, the apical one A, which is not seen in HAECKEL's ring forms, is explained.

We also find a clear and easy transition from *Dictyocircus* to *Ceratospyris hyperborea,* additional meshes appearing on both sides of the ring. The transition here is so evident that — as mentioned under *Ceratospyris* — there may be some reason to suppose that *Dictyocircus* is but a young form of *Ceratospyris.*

That the network in *Dictyocircus* develops into the two lateral domes of *Ceratospyris,* seems quite natural. Several of the most important meshes are directed obliquely outwards from the ring (cf. under *Dictyocircus).* The additional growth therefore at first causes the network to be widened laterally. Later, byspines will be formed on the sides, and these will converge towards the open central space, for the direction of the byspines is generally such as to cover unprotected places. Thus the network of the sides converges and the shell is finally closed.

My opinion, therefore, is that the ring in *Dictyocircus* is basal, not apical, as in similar forms according to HAECKEL's interpretation.

In the second series, there is after *Plectacantha* the development of a ventral sagittal spine. I think I have seen a form which would belong here, very similar to *Plectacantha oikiskos,* but having a ventral sagittal spine; but, as the study of the stucture of these forms has taken a great deal of time, I have been obliged, for the present, to give up the thought of attaining definite clearness with respect to the limits for the different species. It would also have proved impossible to distinguish with certainty between young forms of different species and genera, unless the most important structural conditions had first been settled.

From the *Plectacantha* type, there is a further development to *Phormacantha hystrix,* a ventral, sagittal spine as well as several arches being developed. These arches are apical, extending from the apical spine to the three basal ones or to the primary basal arches. I have not found time to study the course of these apical arches more closely; but there regularly appears to be one from the dorsal branch of the apical spine (d_d, fig. V) to the dorsal branch of the dorsal main spine, one from the right branch of the apical spine to the right lateral arch, B_l, as well as one from the left branch of the apical spine (here the apical spine has the primary verticil of branches) to the left lateral arch, B_l.

Besides these, there are also secondary apical arches outside the primary ones, distally, or between them.

It is interesting to note that *Phormacantha hystrix* shows the same course for the primary branches and the primary arches as *Plectacantha oikiskos.* Only in the case of *Phormacantha,* the formation of arches has reached a further stage and the tips of the branches have mostly disappeared (the branches have become parts of the arches). Similarly, the outer branches of the primary verticil of the lateral main spines are retrograded and on well developed individuals transformed into short spines. The ventral, sagittal spine is bent more downwards than the lateral ones, these being directed more forwards and the apical one more backwards. Thus is formed an interesting type, which in one respect exhibits a remarkable likeness to the *Cladoscenium* type, while it is, on the other hand, difficult to separate with certainty from HAECKEL's group *Monocyrtida.*

The spine which HAECKEL, in Cladoscenium and the whole group *Monocyrtida,* calls the apical spine (apical horn) is the same which I have called the dorsal, basal spine, D. Closer consideration will prove that this opinion is justified (cfr. under *Phormacantha, Cladoscenium, Peridium* and *Lithomelissa).* Similarly to the foregoing ought, therefore, *Cladoscenium* and *Monocyrtida,* as well as the other *Cyrtoidea,* to be placed in the contrary position with the „*cephalis*" (HCK.) downwards, and not as HAECKEL has done, with the *cephalis* upwards and the „*thorax*" and the „*abdomen*" downwards. One would get the same relationship between the groups if one retained HAECKEL's method of placing them for *Cyrtoidea,* but turned the preceding ones over so that the three spines (HAECKEL's „basal tripodium") turned upwards, and one — according to the above designation the apical one — downwards. In this way, the network in *Plectacantha* and *Phormacantha* should be considered as apical, not basal.

If, however, one goes in the natural order from the simple forms, without a network or with a very incomplete one, to such ones as the *Cyrtoidea,* it seems most natural to consider the three spines — as above — to be basal, not apical.

On the whole, perhaps this is the right place to say a few words about the natural position of balance in the water.

Haeckel considers those forms which have a marked principal axis to be „monostatic", supposes that they swim in one definite position of balance. As the skeletons of *Nassellaria* with their substantial spines and net walls must be considered decidedly heavier than water, their plasmatic parts are most probably lighter, in order that the form may be able to float in smooth water, when no selfmotion is supposed.

It is another matter, whether it follows from this that these forms are monostatic, as Haeckel supposes. It seems, however, natural to conclude that the plasmatic parts support the skeleton and not the reverse, so that it would appear most likely that the central capsule is situated under, not over „the tripodium" (in those forms which have an imperfect skeleton).

If, however, the centre of gravity of the plasmatic parts is under „the tripod", it is not impossible that the centre of gravity of the tripodium, by which, naturally, the basal position is determined, may coincide with that of the plasmatic parts, and thus the balance in the water be indifferent.

One would think that such a position of balance would provide important advantages and would safeguard against a separation of the central capsule from the plasmatic parts of the skeleton. There are, moreover, several details concerning the different *Nassellaria* skeletons which seem to suggest that the centre of gravity of the skeleton is very near that of the plasmatic parts. Thus the substantial „tophorn" (Hck.) which is found in numerous forms of *Cyrtoidea* may be mentioned as an instance of this. It is especially this solid tophorn which makes it appear not improbable that the centre of gravity of the skeleton, if it does not coincide with that of the plasmatic parts, even might well be nearer the *cephalis*, so that the form when thoroughly balanced would swim with the *cephalis* and the tophorn downwards.

In this connection, it is an interesting fact that the central capsule in several *Cyrtoidea* — e. g. *Clathrocyclas*, *Corocalyptra*, *Dictyophimus* (cfr. Haeckel, L. 86, pl. 60, 61) is lobed, and has a small part in the *cephalis*, while four long, widened bags extend through a large part of the *thorax*. If these bags are lighter than water, their natural position in the heavier skeleton will be upwards (although the species, of course, would also swim steadily with the *cephalis* upwards, if only the centre of gravity of the skeleton lies under that of the plasmatic parts).

Here I will not omit to add that this peculiar condition of the central capsule in *Cyrtoidea* suggests an original placement in the *cephalis*, while later on it has got its greatest volume in the *thorax*. This again points decidedly to the probability that those forms which have an imperfect skeleton are to be considered as *Monocyrtida* with an imperfectly developed *cephalis* (and no *thorax)*.

The apical arches and their secondary arches in *Phormacantha* form a continuation of the net work up over the sides of the apical spine A, thus causing an enclosed dorsal spine, i. e. a *„columella"* (Hck.), as in *Euscenium* Hck. and *Cladoscenium* Hck. The *columella* is as yet only partially embodied in the skeleton. At the same time a further development of the opposite part takes place, a rather complete wall being formed outside the ventral arch, below the ventral sagittal spine, if this is considered as directed downwards. Probably this is to prevent that the centre of gravity of the skeleton shall be moved to one side.

The genus *Cladoscenium*, as it is represented by *C. tricolpium*, with an almost central *columella* and even development of the skeleton all around it, may quite plainly be derived from an interesting, simple form, *Protoscenium*, which can again be traced back to the *Plagiacantha* type. We may imagine the original type with the four main spines developed evenly, and having the primary verticil of branches on each of them placed in regular order. (Cfr. fig. VIII). If one now imagines 4 basal arches formed between the nearest branches of the dorsal spine, D, on the one side, and each of the lateral spines, L, on the other (cfr. the lines . . . . on the figure), 2 similar arches between the nearest branches of the apical spine, A, on the one side, and the dorsal spine on the other (cfr. the lines — — — — on the figure) and finally 3 arches between the nearest branches of the apical spine and the lateral ones, (cfr. the lines —· —· — on the figure) one has the *Protoscenium* type. Here there is an almost central *columella*, which naturally presents itself as an „apical spine" in contradistinction to the other three, which are all about equally developed and want the outer branch in the primary verticil, while in the *columella* all three branches are well developed.

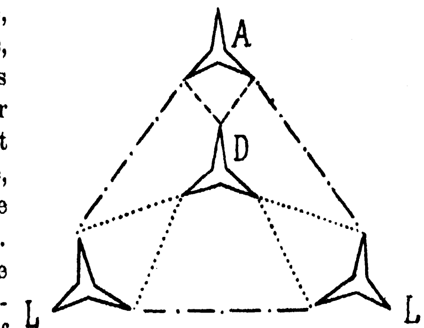


Fig. VIII. The *Protoscenium*-type; oblique apical view.

The *columella*, however, also here corresponds to the dorsal spine in the foregoing species. This will also be seen if we regard the natural position of the central capsule, between D, L_r and L_l.

From *Protoscenium simplex* to *Cladoscenium tricolpium*, we have again a very plain transition. The branches of the primary spines lose their tips and become parts of the arches (as in *Phormacantha)*. The three branches from the spine D are the verticil on the apical spine (after Haeckel). A ventral sagittal spine is also developed, and in this way, perhaps, a counterbalance is formed to the net work at the spine A.

From the *Plectacantha* type a series of forms may again be traced. The net work closes at the base (cfr. corresponding process in *Ceratospyris)* and we have the genus *Peridium*, which always seems too to have the ventral, sagittal spine which often is, however, but weakly developed. One can here, partly because of the meshes round the dorsal spine, more especially because of the characteristic peculiarity in the position of the ventral and left lateral arch, (suspended from a common, basal, primary branch from the left lateral spine, cfr. *Plectacantha)* be convinced that Haeckel's „apical spine" corresponds to the basal dorsal spine, D, in the genera with imperfect skeleton. One finds also in *Peridium* several of the characteristic peculiarities of *Plectacantha oikiskos*, e. g. the larger, secondary meshes with their conspicuous byspines.

If the connection with *Plectacantha oikiskos* may be taken as certain — there is, perhaps, an intermediate form, the one already mentioned which resembles *Plectacantha oikiskos*, but has a ventral sagittal spine — the connection between *Peridium* and *Cyrtoidea* is at any rate quite as certain. Here, however, as mentioned above, the *„cephalis"* corresponds to the basal network of the simpler forms. One can plainly see in young *Cyrtoidea*, where it is principally the *cephalis*, which is fully formed, how the *thorax* is developed between the outward pointing byspines on the primary and secondary arches of the *cephalis*.

In *Lithomelissa setosa*, which can quite naturally be derived from *Peridium*, the spine A runs inside the *thorax*, which it then

pierces in a direction obliquely downwards. In this way it undoubtedly takes an important part in the formation of the *thorax*, partly with branches, partly with arches to the other primary spines. The spine D runs nearly in the *cephalis* wall, obliquely upwards, as an apical horn — „tophorn" (Hck.) — which is but little conspicuous, while the spines L_r and L_l pierce the *thorax* in, or a little below, the „neck". The ventral sagittal spine protrudes obliquely from the region of the neck as a lower „frontal horn" (Hck., in contradistinction to the „apical spine" as a „higher occipital horn").

The peculiar swellings seen in the region of the neck in *Lithomelissa setosa* and similar forms, will find a natural explanation through the above mentioned process of formation of the *thorax*, and this also gives an explanation of the indistinct outer boundary between the *cephalis* and the *thorax*. The proper boundary is to be found near the primary arches, where it is defined by internal lists („cortinar septum" as Hck. mentions in some species). These are not in the same plane, just as in *Plectacantha* and *Peridium*. As the secondary spines on the left and right lateral arch through additional secondary arches now form the adjoining part of the *thorax*, two crimpings on the sides about the spine D will be caused at the boundary between the *cephalis* and *thorax*.

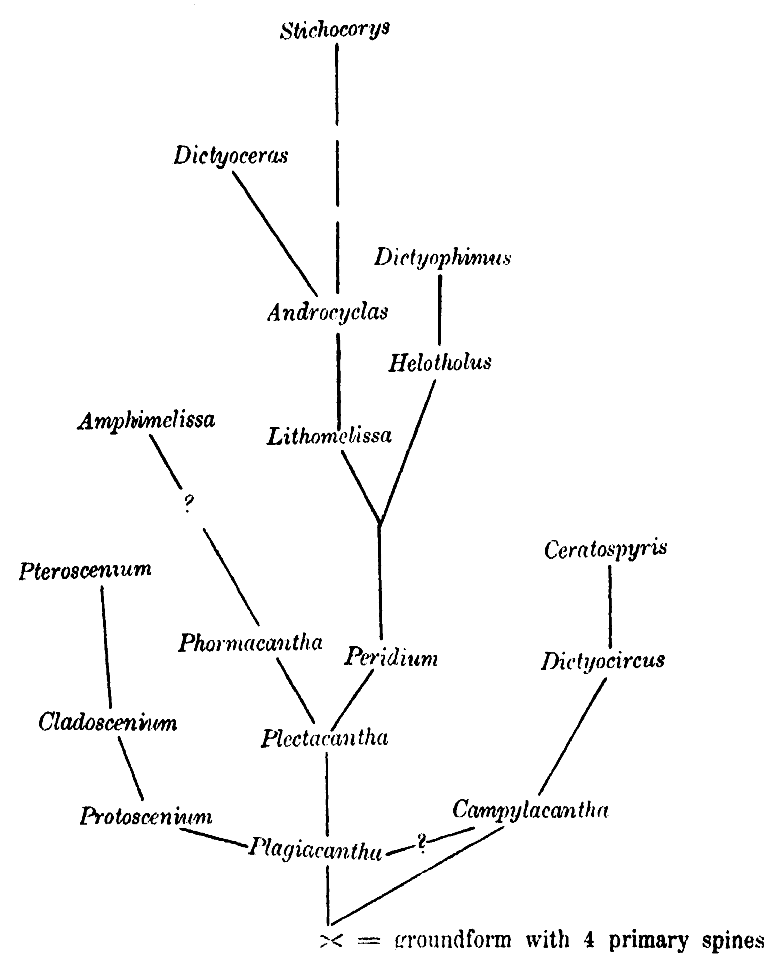
In *Cyrtoidea* there is also developed an inner spine, which extends from the central rod through the *thorax*. It appears to be very variously developed, and is sometimes branched. It always seems to extend from the ventral end of the central rod, at the same point which is also the starting point for the primary, lateral spines and the ventral sagittal one, and it extends in a direction contrary to the *cephalis*. Its object seems to be to protect the large opening, which is the weak point, or perhaps it is to act as a support for the lobes of the central capsule. As a rudimentary spine, it can be traced right back to *Phormacantha*.

The more richly developed the *Cyrtoidea* forms become, the more it seems that the original spines and arches are retrograded. The four primary spines, as well as the ventral, sagittal spine can, however, be clearly recognized in every instance, as far as my experience goes. In the genera *Helotholus*, *Androcyclas* and *Clathrocyclas*, perhaps also *Stichocorys*, 3 of these spines, A, L_r and L_l, are found as simple, protruding spikes. In the genus *Androcyclas* the spine D forms the large, substantial „tophorn" (Hck.). Similarly in *Clathrocyclas*, where the other „tophorn" is formed by the protruding ventral sagittal spine.

The consecutive links of the many linked *Cyrtoidea* are formed out from the *cephalis* as may easily be proved in young individuals. Such forms as *Lithomelissa* will, therefore, when young resemble *Peridium*, *Clathrocyclas* and *Androcyclas* and be similar to *Dicyrtida* (instead of *Tricyrtida*) etc.

The genus *Amphimelissa* (*Botryopyle setosa* Cl.) seems to have a structure which is considerably different to that of *Lithomelissa*, with a fuller development of the primary skeleton parts of the *cephalis*. If I have understood it rightly, it would seem that its *thorax* is formed from the *cephalis* by secondary spines on the secondary arches, that is with the starting point higher up on the *cephalis*, while the *thorax* of *Lithomelissa* and similar genera are chiefly formed from the primary arches and their byspines. The result is therefore, that *Amphimelissa* has a broader *cephalis*, which is more enclosed, or even entirely so, and which does not distinctly appear to be separated from the *thorax*. (Cfr. further under *Amphimelissa*).

The genealogical tree for the forms which occur in my material will, after the foregoing, be as follows:



In the following pages, I have for practical reasons preferred to retain (at any rate preliminarily) Haeckel's method of placing the *Cyrtoidea*, where therefore the „apical spine" is the spine D, and the „dorsal one" the spine A, while further the right and left lateral spines change places. Where, however, letters are used, I have applied them as above.

With regard to the distribution of the species of *Nassellaria* which I have observed, I will add a few remarks, and these will also, as a whole, be applicable to the above mentioned species of the division *Spumellaria*.

It is difficult, from the material treated, to come to any reliable conclusion as to whence the various species really come, and this indeed is the case with most of the plankton species which occur in my material. We know very little indeed about the distribution of these *radiolaria*, for the majority of the species found are either quite new or had only previously been known from the west coast of Norway. But, fortunately, Cleve has also observed some of the species in question (especially from the sea near Spitzbergen), so that the distribution of just these species can be rather more completely stated. It has also been of great service to me that Dr. Hjort and Dr. Gran have kindly favoured me with a number of plankton samples for examination which were taken on S/S Michael Sars' expedition in the Norwegian Ocean. I have, however, not yet been able to find time to work through the whole of this material, which, having been collected from settled places in the most important currents, will supply valuable information with re-

spect to the dependence of the *radiolaria* on temperature and salinity. Unfortunately, there are no samples from deeper water.

It may, nevertheless, be concluded with certainty that all the species here mentioned of the divisions *Spumellaria* and *Nassellaria* are oceanic species. There may, however, be differences of opinion as to whether they are northern or southern forms. CLEVE states (L. 40) that some species which belong here (from the Northern Atlantic) must be considered to be derived from the Northern Pacific by way of the Northern Arctic basin. He comes to this conclusion partly because several of these species have been found in the northern part of the Pacific, and partly because they do not occur in samples taken farther south than 40° n. lat.

GRAN (L. 70, p. 149—154) considers these species to be of southern origin.

As far as I can gather, CLEVE's statements are generally based upon examinations only of surface samples. My impression is that the majority of these *radiolaria* come from the northern part of the Atlantic, where they appear to occur in the mixed Atlantic waters. In the deeper waters of the Norwegian Ocean, there are, perhaps large numbers of these northern species. In a deep water sample from the sea between the Faeroe and Shetland Isles, which was taken by Mr. CLARK and kindly placed at my disposition for examination, I found a comparatively large number of those species which occur on the coasts of Norway, and some of these species were numerous.

It appears to be certain that ocean water of between 34 and 35 ‰ salinity contains many species of these *radiolaria*. Perhaps here too they occur for the most part in the deeper layers.

On the other hand, there appears also to be species (of those mentioned in this paper belonging to *Spumellaria* and *Nassellaria*) which belong to the salter, warmer waters of the Atlantic, but their number is comparatively small.

Key to the genera of Nassellaria.[1])

Shells with plainly latticed cephalis and thorax, or more joints.

- More than 3 joints; rather narrow shell with no or inconspicuous spines .... *Stichocorys.*
- 3 joints (cephalis, thorax and abdomen).
  - Thorax with 3 long protruding spines, each with a broad base; no broad tophorn .... *Dictyoceras.*
  - Thorax with 3 to 4 slender and short spines which may easily be overlooked.
    - 2 diverging, 3-edged tophorns; broad thorax; short, expanded, brim-shaped abdomen .... *Clathrocyclas.*
    - 1 conspicuous, 3-edged tophorn; thorax narrower, not brim-shaped .... *Androcyclas.*
- 2 joints (only cephalis and thorax).
  - Cephalis rudimentary; large thorax .... *Litharachnium.*
  - Thorax little developed with narrow spines which form 6 or more „basal feet" .... *Acanthocorys.*
  - Thorax with piercing, 3-edged spines or with 3 regular basal feet .... *Dictyophimus.*
  - Thorax with piercing, slender spines without conspicuous edges.
    - Thorax broad and low, campanulate; cephalis with numerous spines .... *Helotholus.*
    - Thorax narrow and high.
      - Cephalis very broad, not plainly constricted from the thorax ..... *Amphimelissa.*
      - Cephalis narrower than the thorax, easy to distinguish ..... *Lithomelissa.*

Only cephalis, plainly latticed.

- Cephalis with a sagittal ring (bilocular) *Ceratospyris.*
- No sagittal ring.
  - 5 long, 3-edged spines, one of them forming a nearly central columella with an inner verticil of 3 branches and protruding above as a tophorn .... *Cladoscenium.*
  - The same, but the columella wanting the inner verticil of branches .... *Euscenium.*
  - No broad, 3-edged spines.
    - No columella .... *Peridium.*
    - (Incompletely latticed shell with indistinct, marginal columella .... *Phormacantha*).

More or less incomplete skeletons, not plainly latticed.

- A strong sagittal ring with spines and some few meshes .... *Dictyocircus.*
- No sagittal ring.
  - The ventral sagittal spine is present.
    - Rather well developed network (at last with numerous slender arches and spines at the outside) *Phormacantha.*
    - No network, only strong, bent spines with numerous scattered branches .. *Campylacantha.*
    - (5 strong, straight, 3-edged spines........... *Euscenium*).
  - The ventral sagittal spine is wanting.
    - A very incomplete cephalis with very few, large meshes and nearly central columella .... *Protoscenium.*
    - No columella.

[1]) Only to help in the determination.

Only two pentagons with a side in common and the opposite corners connected through a polygonal beam; long spines in the corners	*Gonosphæra.*
More or less developed network, forming a conical cephalis, open below	*Plectacantha.*
Only the 4 main spines with a verticil of 3 branches on each of them; no or but few connecting arches developed	*Plagiacantha.*

VII C. 1. Plectoidea Hck. (Plagonida and Plectanida).

Plagiacantha *arachnoides* Clap.

Jørgensen L. 91, p. 72.

In a previous paper (Jörgensen l. c.), I have in detail described the structure of this species and shown that, from this structure, it would have to be classed as belonging to Haeckel's genus *Plagiocarpa* or — the form which is furnished with connecting beams — to *Periplecta* Hck. At the same time too is mentioned that this structure — as it is explained in the foregoing pages here — is the ground type for a large series of forms.

It is likely that still other species are included in the above name. Haeckel's *Plectophora arachnoides* can, however, not be distinguished from *Plagiacantha arachnoides*.

In the present material, this species was found only rarely and in small numbers, generally in deep water samples, up to 50 m., only exceptionally near the surface. Almost entirely absent during the diatom inflow.

Distribution: According to Cleve (L. 40, p. 180) a northern form, belonging to Tricho- and Chætoplankton. Frequent on the west coast of Norway, seems also there to be absent during the diatom inflow. In August 1903, numerous between the Faeroe and Shetland Isles and in the sea north of them, near the surface (L. 18, 1903—1904, nr. 1).

The species would thus seem to belong to the northern part of the Atlantic, and especially to be abundant in the North Sea and north of Great Britain during the summer months.

Campylacantha n. gen.

Has the four primary spines, D, L_r, L_l and A, as well as the ventral, sagittal one, V. The dorsal, sagittal one, D, is bent strongly downwards. The lateral, basal spines, L_r and L_l, are also bent downwards, being as usual directed half forwards and half sideways (so as to be ventral lateral). The ventral, sagittal spine is rather thin, almost straight, bent strongly downwards and converges distinctly towards the dorsal, basal spine, D.

The principal difference between this and the previous genus lies in the ventral, sagittal spine.

The primary verticil of branches (cfr. the introductory remarks under *Nassellaria)* appears only on the apical spine, which is without any other branches.

C. *cladophora* Jörg. n. sp.
(Pl. XII, fig. 47).

The sagittal, basal spine is best developed, very strong, long, strongly bent, gradually narrowing off into a long fine point, like all the stronger main spines and branches three-edged. One edge is dorsal, the others lateral. On these three edges, there are strong, expanded, narrow pointed branches, several in a row along the same edge, rather scattered and not clearly forming verticils when compared to the branches on the other edges. The branches become shorter towards the end of the main spines. The larger branches are in their turn furnished with similar squarrose branches.

The basal, lateral spines are also strongly developed, although not quite so much so as the sagittal, dorsal one, in other respects corresponding precisely in form and arrangement of branches.

The apical spine is much less developed, having only a verticil of three branches on the corresponding place to the verticil of *Plagiacantha*, outside this being thin and unbranched.

The ventral, sagittal spine is thin and unbranched, almost straight, pointing obliquely downwards between the lateral spines and being somewhat shorter than these.

In addition, in well developed forms, there appears to be two strong, lateral arched branches extending from the basal, dorsal spine at the base of the apical spine. These arched branches form a pair of secondary, lateral spines, l_r and l_l, in form and arrangement of branches corresponding to the primary, lateral spines, only less developed. In those individuals where a smaller numbers of secondary spines were developed, they were not visible. But it must be remarked that the species is very brittle, so that the branches are easily broken off.

This species is especially interesting, as it seems to show the evolution of the ring species. Cfr. above and under the following species.

Rare, always in small numbers, only in deep water samples. Seems to be boreal oceanic.

Distribution: Otherwise only observed on the west coast of Norway: The Oster Fiord, very scarse, in deep water.

VII C. 2. Stephoidea Hck. (Stephanida and Semantida).

Dictyocircus n. gen.
(Cfr. pl. XIII, f. 48).

A strong, sagittal ring, one side, the dorsal, being less bent than the other, the ventral. (This peculiarity of the ring species is also mentioned by Haeckel). This ring is in the following description supposed to be placed downwards, not upwards as by Haeckel.

On the dorsal side of the ring, there is a long spine, pointing obliquely backwards and upwards, the apical spine, A, in the plane of the ring. On both sides of this apical spine, there are two large, pentagonal meshes, diverging at right angle on each side, both in the same plane perpendicular to the plane of the ring. These are the right and left transverse meshes, a_r and a_l. These meshes are again both in a dorsal and ventral direction joined to two similar pairs of meshes, the dorsal lateral meshes, f_r and f_l, situated in a dorsal direction from the transverse meshes, and the ventral, lateral meshes, b_r and b_l. These lateral meshes point obliquely outwards from the plane of the ring. They are thus not in pairs in the same plane, but the plane of the right one forms an angle with that of the left one, both being turned from a position perpendicular to the plane of the ring in a direction away from the centre (fig. IX).

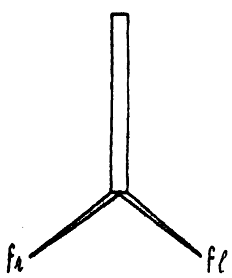


Fig. IX. *Dictyocircus:* Ring and meshes f, apical view (schematically).

In a ventral direction from the pair of meshes b, 3—4 more or less complete pairs of meshes follow, c to e; in a dorsal direction, however, there are only three protruding spines, g, the middle one being in the plane of the ring, the other two pointing obliquely outwards and downwards. Similar protruding spines are found at several points (cfr. the description of the species).

Although I am but imperfectly acquainted with this form, having only seen a couple of individuals, I have endeavoured to trace its structure as complety as possible, as it is a very interesting form, which seems to be well suited to throw light upon the connection between the ring forms of *Nassellaria* and the group *Plectoidea* Hck. on the one hand and the group *Zygospyrida* Hck. on the other.

The connection with the latter seems to me to be quite evident, leaving scarcely no doubt that such forms as *Ceratospyris* are evolved from a ring like *Dictyocircus* with a further development of meshes on both sides outside those described, until there is on either side formed a closed network. The conspicuous narrowing in *Ceratospyris* at the sagittal ring corresponds very beautifully to the right and left meshes which extend forwards from the ring, e. g. in the pair of meshes b and f.

The connection with the group *Plectoidea* is less clear. On this point, however, the genus *Campylacantha* seems to furnish valuable information. As above mentioned, I consider the sagittal ring to be formed by the connection of the dorsal and ventral sagittal spines (or of meeting branches). Further, I consider the branches h_r, h_l between the meshes a and b to correspond to the ventral, lateral spines in *Campylacantha,* and the branches i_r, i_l between the meshes a and f to correspond to the dorsal, lateral ones. In this way too, the large transverse meshes a, diverging at right angles, situated between the dorsal and ventral lateral spines in *Campylacantha*, are explained, as well as the centrifugally directed pair of meshes b and f, formed by the partly forward pointing ventral, lateral spines, and the partly backward pointing dorsal, lateral ones.

D. clathratus Jörg. n. sp.
(Pl. XIII, fig. 48).

To the description above, I will add the following, which applies to the individual illustrated:

After the pair of meshes a and b, there follows in the same direction (ventrally) two strong, but smaller meshes, c, one on each side. In the corner between b_l and c_l there is a secondary, smaller mesh. After c_l there follows yet another mesh, d_l, while the corresponding one on the right side is wanting, but there is a trace of it in the shape of a protruding spine. (This mesh is probably developed in elder individuals). Then comes a pair of strong, obliquely diverging spines, k, and then two similar ones, g, with an intermediate one in the plane of the ring, which spine might be considered to be the protruding point of the primary dorsal (basal, sagittal) spine. Following this bundle of three spines there are, in the same direction, the two large meshes f, which again stretch up to the pair of meshes a.

On the stronger branches, there are several protruding spines, which generally point obliquely outwards from the plane of the sagittal ring, in a direction away from the centre. Besides these, there are three spines protruding in the plane of the ring, the apical spine, the protruding, dorsal, basal, sagittal one at g, and the protruding, ventral, sagittal one between the meshes b and c (broken off on the specimen illustrated).

In addition to these, we have some secondary spines, as for instance the conspicuous twins on the outer side of a_l. The two meshes b_r and b_l are connected by an arched (ventral) beam which is bent outwards, and carries in the middle a rather strong, secondary spine pointing outwards.

The sagittal ring and all the stronger branches and spines are three edged.

The diameter of the ring is about 50 μ.

The individual described was probably not fully developed. Judging from the many surprises which have met me with regard to imperfectly developed *radiolaria*, I cannot but remark that it is perhaps not altogether impossible that the *Dictyocircus clathratus*, here described, is a young form of *Ceratospyris* or a similar species of the group *Zygospyrida.*

This species does not answer well to Haeckel's system, so I have been obliged to classify it as a separate genus. It would have had to be classed as belonging to the group *Semantida* Hck. in which there are species which in structure in important respects undoubtedly agree very well with the species here described. It especially answers well to the genera *Semantidium* Hck. and *Semantiscus* Hck., both of these having the three large pairs of meshes corresponding to a, b and f. These genera have, however, not the long apical spine.

Very rare and only singly: Henningsvær, 20/3 1899, 0—280 m.

VII C. 3. Zygospyrida Hck.

Ceratospyris Hck.

I do not consider this genus to be well characterized by Haeckel; but it is, at any rate, easily recognized.

In the material examined, I have only found one species belonging to it.

C. hyperborea Jörg. n. sp.
(Pl. XIII, fig. 49).

I have only seen very few individuals of this species. Its structure seems to be of precisely the same type as that of *Dictyo-*

circus clathratus, only that, on both sides of the sagittal ring, there is a further development of the net work, which has become two complete domes, one on each side.

The primary pores (nearest the sagittal ring) are polygonal, the others being irregular roundish and oblong and varying considerably in size. The separating walls are strong, with here and there narrow, protruding points which form obliquely diverging narrow spines. There is also a rather plentiful number of similar byspines.

All the spines are little prominent, to $^1/_4$—$^1/_2$ of the diameter of the sagittal ring.

The species does not appear to be identical to any of Haeckel's.

Very rare and only singly: The Vest Fiord $^1/_3$ 1899, 0—200 m.

Distribution: In the warm, salt waters of the Atlantic beyond Søndmøre (S/S Michael Sars, $^2/_3$ 1901, between stations 4 and 5, in the surface; cfr. Gran, L. 70, p. 149), very sparsely; the Oster Fiord near Bergen, at a great depth, here too only singly.

VII C. 4. Monocyrtida Hck.

The genera *Plectacantha* and *Phormacantha,* as also the genus *Protoscenium,* should properly be referred to the group *Plectoidea* Hck. (in account of their more or less incomplete skeletons), but is placed here in order not to break their natural connection with the following genera.

Plectacantha n. gen.
(Pl. XIII, f. 50—58).

Has the four primary spines, the sagittal, dorsal, basal one, D, the two ventral, lateral, basal ones L_r and L_l, as well as the sagittal, apical one A. Besides there are, between these, three primary arches developed, one ventral, B_v, between the ventral, lateral spines, and two lateral B_r and B_l, between the dorsal, basal spine and the right and left lateral one. In this way, 3 large, pentagonal meshes are formed, the primary ventral mesh, the primary right lateral and the primary left lateral meshes.

As mentioned above in the general remarks on the *Nassellaria* group, the ventral mesh and the left, lateral one have as a side in common a short branch which descends from the under side of the left, lateral spine, while, on the other side, the right, lateral mesh and the ventral mesh reach immediately up to the right, lateral spine.

There is no ventral, sagittal spine extending from the common starting point for the two ventral, lateral main spines.

In addition to these primary spines and arches, secondary ones are also more or less developed, and form a comparatively rich network, which is, however, open, or very imperfectly closed beneath.

P. oikiskos Jörg. n. nomen.
(Pl. XIII, figs. 50—57).

Periplecta intricata (Cl.) Jörg. L. 91, p. 73.
Peridium (?) *intricatum* Cl. L. 30, pl. 2, f. 8 a, b?
Peridium (?) *laxum* Cl. l. c. pl. 2, f. 9 a, b?

The primary verticil of branches of the apical spine has (generally?) only two branches, pointing upwards and outwards in the angle between the dorsal, basal spine and the lateral ones. These two branches together with the protruding middle stem form three undivided spikes, about equal in length.

The left, lateral spine, L_l, has the primary verticil complete. Of these three branches, however, the inside one (l_{li} in fig. V, p. 124) is — as previously mentioned — transformed into a short, strong arch, pointing downwards, at the end of which the left, lateral arch and the primary, ventral one meet. The two other branches form with the protruding middle stem, three, diverging, long, single spikes, pointing obliquely outwards and to the sides. By these three long, protruding spikes, the left, lateral spine may always be easily recognized.

The right, lateral spine has only retained one branch of the verticil in its original form, the other two being branches for the two corresponding, primary arches, one belonging to the ventral arch, the other to the right, lateral one. There are consequently here two long, simple spikes, about equal in length, the outer branch in the primary verticil and the protruding, middle stem.

The dorsal, basal spine has only one simple branch of the verticil, pointing outwards and upwards (d_d in fig. V, p. 124), the two others being strong, arched branches, diverging nearly at right angle on both sides.

One of these branches forms the right, the other the left lateral arch. The middle stem of the basal spine is here branched, there being one or two similar secondary arches outside the primary, lateral ones. The dorsal, basal spine, therefore, only shows one simple, protruding spike. A similar, smaller byspine is generally to be found farther out.

The dorsal spine is the longest and strongest, the apical one is shortest and weakest.

Outside the primary meshes, secondary ones are developed more or less richly, varying considerably in size. These unite to form a „network" which is generally rather imperfect, but would seem, on older individuals, to be made more complete by the addition of connecting beams across the larger, secondary meshes, so that these meshes finally are smaller in size and more in number. Generally speaking, the network is conically expanded downwards, and seems, in the case of older individuals, finally to be imperfectly closed beneath by the development of a few, fine, long, transverse beams. In the material examined specimens with such nearly closed network were always rare.

Of the more important byspines and secondary meshes, I will only mention the following which seem always to be present, and may serve to help in identifying the species. Under the protruding right lateral spine a large, secondary, pentagonal mesh will be found. The left, lateral arch has a strong byspine in the middle, pointing outwards and upwards, and under it, there is a large, secondary mesh. On both sides of the dorsal spine, outside the primary, lateral arches, on the left side will be found two secondary meshes, and on the right side one; the latter being the largest, but it is perhaps later on divided into two.

Moreover, on all the stronger arches, there is a more or less rich development of byspines, pointing outwards and upwards, sometimes twins, directed upwards-outwards and downwards-outwards.

The beams are thin in young individuals, especially at the

outer secondary meshes; they are much stronger on older individuals.

The length of the basal, dorsal spine is $\pm$ 55 μ.

Cfr. Jörgensen l. c.

I considered this species first to belong to the genus *Periplecta* Hck.; but as I later on found that what with Haeckel characterises this genus is also characteristic of all closely related genera, as I am acquainted with them from plankton samples (not drawings), I have been obliged to change the name of the genus.

I at first considered this species to be Cleve's *Peridium intricatum*, and this may be correct, but it cannot be proved to be so from Cleve's illustration nor from his description. As it is, moreover, quite as probable that Cleve's *Peridium* (?) *laxum* also belongs to this species, I consider it best to retain the manuscript name I originally had given the species before Cleve's work was published.

Not rare, but always in small number.

Distribution: Not rare on the west coast of Norway, always scarce. Probably boreal oceanic.

P. trichoides Jörg. n. sp.
(Pl. XIII, f. 58).

Peridium (?) *laxum* Cl. L. 30, pl. 2, f. 9 a, b?

I have only an imperfect knowledge of this species, as I have only seen a few specimens, and at first took these to belong to the preceding species.

It has the same primary spines and primary arches; but there appears to be the important difference that the ventral, primary arch and the left, lateral arch both extend to the left, lateral spine, not to a common basal branch from the latter. On the other hand, there is a strong, secondary arch between the left, lateral one and the nearest side of the primary, ventral one.

In outer appearance, this species is very different from the foregoing one. Instead of the numerous secondary meshes, long connecting arches are developed, which form together a longish, ovate, very imperfect network of long, fine arches. The largest and strongest of these run between the two lateral arches and form a very large, ovate mesh, pointing downwards. On its sides, especially in a ventral direction, similar large meshes are developed, bounded by fine arch branches, which run from the primary arches to the said large, secondary one, or between secondary arches. On these arch branches, very fine spines are scattered, these probably later on being developed into arch branches between the secondary arches. It is likely that a network wil appear which is imperfectly closed beneath by basal, secondary arches, on elder individuals.

On the primary, basal spines, short byspines are also found on the pieces inside the primary arches.

This species is undoubtedly different from the foregoing. It is not certain whether it should be reckoned as belonging to the same genus; but it wants, as does the foregoing one, the ventral, sagittal spine.

Very rare and scarce, though certainly to some extent overlooked: $^{19}/_{1}$ 1899, 40 miles N. W. of Gaukværø, 0—700 m.

Distribution: Also on the west coast of Norway, but only occasionally and in small numbers.

Phormacantha n. gen.

Has the same four primary spines and the same three primary arches as *Plectacantha*. There is, however, also a ventral, sagittal spine, which is less strongly developed than the others („der secundäre Mittelstachel", Jörgensen L. 91, p. 77). The network, as in *Plectacantha*, is at a late stage and only imperfectly closed beneath.

P. hystrix (Jörg.)
(Pl. XIV, figs. 59—63).

Peridium hystrix Jörg. L. 91, p. 76.

The primary spines and primary arches as in *Plectacantha oikiskos*. The ventral arch and the left, lateral one also here run together to a strong, basal arch branch from the left, lateral main spine.

Outside the ventral, sagittal spine, there is an extended network of numerous, secondary meshes, which both below and on the sides are connected by fine transverse beams to a corresponding one on the sides of the dorsal sagittal spine. In this way a network is formed, which is imperfectly closed beneath.

There are numerous byspines. Between these and the larger beams more or less numerous and mostly thin, arch-shaped, connecting beams are extended, which are in their turn here and there connected by similar, arched, fine beams, which at a later stage of development are provided with numerous, fine spines. These are, possibly, later, at any rate to some extent, developed to similar fine connecting arches, which more or less completely envelope the network.

The development of the arches is here further advanced than in *Plectacantha oikiskos*. From the three branches of the apical spine, arch branches extend, the apical arches, one to the dorsal, basal spine, and two to the primary, lateral arches. These apical arches may at the corners, as well towards the apical spine, as towards the dorsal one and the primary arches, be enveloped by similar arches.

Cfr. also Jörgensen l. c. p. 77.

At a younger stage, this species strongly resembles *Plectacantha oikiskos*. The ventral, sagittal spine, however, makes it easy to distinguish between them. At an older stage, they are so different that they can hardly be confounded.

It is likely that there is more than one species which belongs here.

This form is very interesting, clearly being a connecting one between the groups *Plectoidea* and *Monocyrtida*. I formerly considered it to belong to the genus *Peridium*, and there is hardly any great or important difference in the structure of the genera *Peridium* and *Phormacantha*. It seems, however, most practicable to separate the imperfectly latticed forms from those which have a regularly developed lattice work which is closed beneath.

On the other hand, this genus — as more fully explained in the introductory remarks to *Nassellaria* — forms clearly a transition to the genera *Euscenium* Hck. and *Cladoscenium* Hck. When the apical arches are further developed, an enclosed spine will result, a „columella".

The larger forms have a „network", which is about 70 μ in height.

Rather frequent, though never numerous, in deep water samples.

Distribution: The same as that of *Plectacantha oikiskos*.

Gonosphæra Jörg. n. gen.

The very peculiar, little species which belongs here, seems to be constructed in the following way:

There are two rather regular pentagons, having one side in common. Their planes form an angle of about 120°. At the four corners there are long spines, pointing obliquely outwards in different directions. Between the fifth corners, one in each pentagon, opposite to their common side, there is a three-jointed connecting arch, bent outwards from both the pentagons. This arch carries in the two corners which do not lie in the original pentagons (but farthest away from them), two long, diverging spines.

G. primordialis Jörg. n. sp.
(Pl. XIV, figs. 64—68).

I will add a few remarks to the description already given of the genus. In most positions, this species will have the appearance of a more or less distinct pentagon, with long spines at the corners, and also a connecting arch with three similar spines. Looking straight towards one of the two pentagons (with a side in common), the connecting arch with its spines, will look like two long spines, connected by a short cross beam.

I cannot say where this species really belongs, but judging from the skeleton and the position of the central capsule, it would seem to belong to the *Nassellaria*. I have, however, only once seen the plasmatic parts. The species does not seem to be so very rare, but is easily overlooked on account of its small size.

Found in rather many samples from deep water, always in small numbers.

Distribution: Also on the west coast of Norway. Probably boreal oceanic.

Protoscenium n. gen.
Pl. XV, fig. 69.

With regard to this interesting form, reference should be made to the introduction to the group *Nassellaria*. In the following, it is placed as *Cladoscenium* and the species belonging to the *Cyrtoidea* group, with the spine D upwards and the spine A downwards. The expression, „the apical spine" therefore here has the same meaning as with Haeckel, but is the same as the spine D in the foregoing.

Further, in the following L_r denotes „the left", L_l „the right" lateral spine, cfr. above.

The usual four, primary spines are present, all about equally developed, the apical one (D), however, perhaps best. The basal spines form a very flat pyramid; they are most distinctly directed downwards at the free ends.

The primary verticil with three branches on each main spine is well developed, on each of the three basal ones, however, the downwards pointing (outwards pointing) branch is wanting, while the two others everywhere point regularly upwards and outwards. On the apical spine (D) all three branches are well developed and lie about parallel to the basal spines. All the main spines have also a protruding middle stem, which is about equal in length to the primary branches.

Between sets of two of those primary branches which are nearest and belonging to different main spines, a strong, connecting arch is developed near their ends. Of such arches, there are altogether 9, 3 basal and 6 apical ones.

Of the three basal ones, one runs in a ventral direction, between the ventral branches of the lateral spines, the two others laterally, between the dorsal branches of the lateral spines and the corresponding branches of the dorsal spine (A). From the dorsal branch of the apical spine two apical arches extend to the right and left branch of the dorsal spine, and in the same way, two apical arches from the apical spine's (D) right lateral branch to the two branches of the right, lateral spine, and two apical arches from the left, lateral branch of the apical spine to the two branches of the left, lateral spine.

These arches all meet in twos the branches at the same point, at a short distance from their end. There may also be found a weaker, secondary arch branch extending from the same points of the primary branches, but connecting together in twos the branches of the same main spine, or connecting these branches with the protruding middle stem. In this way, a network which is, on the whole, very open, is formed of very large meshes and thin beams with 9 short spikes protruding from a regular verticil of three branches (the 6 spikes being basal, the 3 apical) and 4 longer simple spikes (3 basal, 1 apical).

This is an interesting species which, as proved in the introductory remarks, may be considered to be the original type for the genera *Euscenium* Hck. and *Cladoscenium* Hck., with a nearly central columella.

P. simplex (Cl.)
(Pl. XV, fig. 69).

Plectanium simplex Cl. L. 30, pl. 3, fig. 3.

Cfr. the description of the genus and the introductory remarks.

Each of the primary branches of the main spines has, as already mentioned, near their end, a verticil of 3 branches, of which the two are the connecting arches mentioned above, the third being a short spine about equal in length to the free end of the branch. This spine may — as above mentioned — be connected with one of the approximate corresponding ones, or with the protruding part of the main spine, by exceedingly fine arches.

Here and there on the outer arches fine byspines are found, which are perhaps partly developed into such hair-like connecting arches.

The species is no *Plectanium* in Haeckel's sense. Cleve draws the apical spine as protruding from the common starting point of the basal spines, and has, probably for this reason, classed the species as belonging to Hck.'s genus *Plectanium*.

I have seen only a few individuals of this species; but I have, nevertheless, no doubt that its characteristic structure in all important points is as above described. Older individuals have, perhaps, a more richly developed network of added, secondary arches.

Rare and only singly: 19/1 1899, 40 miles N. W. of Gaukværø, 0—700 m. Is, however, easily overlooked.

Distribution: Only noticed by Cleve from two places: 78° n., 3° w., deep sea haul; 56° n., 36° w. Probably also boreal oceanic.

Euscenium *corynephorum* Jörg.
(Pl. XV, fig. 70).

Jörg. L. 91, p. 77.

Has the four primary spines, about equally developed, and the ventral, sagittal one.

The main spines are broad, three-edged, broadest in the outer half. On each edge there are from 3 to 5, or more, strong, slen-

der pointed branches (spines), more or less distinctly scattered in comparison to those on the other edges of the same spine, only rarely here and there in distinct verticils.

Between the neighbouring branches of the different main spines, rather long and fine connecting beams extend, these being in their turn again connected by numerous similar ones. Thus a more or less perfect net is formed which is best developed between the apical spine (D) and the ventral, sagittal one. This network forms a rather imperfect lattice shell with meshes, very uneven in shape and size, from small, triangular and trapezoidal to very large, polygonal openings. Also the inner branches (spines) on the same main spine are connected, partly with the main spine itself, partly with each other, also by fine connecting beams, parallel to the direction of the main spine (as in the spines of *Rhizoplegma boreale)*.

The meshes of the lattice shell strongly recall those of *Cladoscenium tricolpium.* Very often (in young individuals) so little of the network is developed that it would not be justifiable to consider the species as a *Euscenium*, if one did not occasionally find a well developed latice shell. Cfr. Jörgensen l. c.

This species is very different from *Cladoscenium tricolpium,* and without doubt is more closely allied to those forms which have an imperfect lattice shell *(Plectoidea* Hck.). It might be classed as belonging to the genus *Periplecta* Hck., if it were not for the distinct, ventral, sagittal spine. (This spine was previously overlooked, and for this reason is not mentioned in my earlier description of the species l. c. p. 77). I prefer at present to let it remain in the genus *Euscenium,* rather than to start a new genus, as the genus *Euscenium* Hck. certainly requires revision.

Cladoscenium ***tricolpium*** (Hck.) Jörg.
(Pl. XV, figs. 71—73).

Euscenium tricolpium Hck. L. 86, p. 1147, pl. 53, f. 12.
Cladoscenium tricolpium, Jörg. L. 91, p. 78.

Here again we have the four primary spines and the ventral sagittal one. The almost central columella corresponds to the basal, dorsal spine, D, in *Plectacantha oikiskos* and *Phormacantha hystrix.* On the other hand, the connection with *Protoscenium simplex* is evident.

From two, somewhat upwards pointing, branches from each of the left and right lateral spine four arches extend upwards and unite in twos (those from the same main spine) to form a strong apical arch. These are the corresponding arches in *Protoscenium simplex,* where they connect the branches of the lateral spines with the corresponding two branches of the apical one (D). The tips of these branches have disappeared in *Cladoscenium*, and the arches pass gradually into the branches. The two corresponding ones in the dorsal spine (A) are also found; but one of them is not particularly conspicuous as there are several similar secondary arches.

The lattice shell (cfr. Jörgensen l. c. p. 78) is particularly perfect between the apical spine (D) and the ventral, sagittal one.

There are, where the main spines protrude, rather large, triangular meshes formed by connecting beams between the larger arches of the shell and the spines, two at the dorsal spine (A) and the left, lateral spine (L_r), three at the apical spine (D). It is only in older individuals that the long, fine downhanging spines are formed on the basal arches (i. e. the arches between the basal spines, A, L_r and L_l).

There does not seem to be anything of importance to prevent us from considering this species to be identical to *Euscenium tricolpium* Hck. It is true that, in Haeckel's illustration, the distinct, ventral, sagittal spine is not present. There are, however, so many details in the illustration, which answer remarkably well to this species that it is highly probable that they are identical. The reason why Haeckel refers the species to the genus *Euscenium,* is that he considers the shell to be closed by the strong apical arches, (which are conspicuous in certain sightings of the microscope) while it really extends farther up along the apical spine, to the three connecting beams above mentioned.

My opinion therefore is still that the species is a *Cladoscenium.* Haeckel mentions the completely corresponding upper arches in *Cladoscenium pectinatum* Hck. (L. 86, p. 1150, pl. 98, f. 2), as a second verticil of branches of the columella.

Frequent, always in small numbers, in deep water, up to 100 m.

Distribution: Not rare on the west coast of Norway, here too sparse, and only in deep water samples. Was found in surface samples from the warmer and salter Atlantic waters ²/₂ 1901, in the sea beyond Søndmøre, ¹³/₂ off Lofoten and ⁵/₃ off Finmarken (cfr. Gran L. 70, pp. 150, 151, 154). Mentioned by Haeckel from a great depth in the Central Pacific. Cleve has found the species at a great depth west of Spitzbergen and at some places in the northern and north western parts of the Atlantic. Cleve (L. 40, p. 161) remarks that the species, though often found together with Styliplankton (temperate oceanic), does not, however, appear to be a Styliplankton form. Cleve considers it likely, either that it comes from the northern polar basin, or from the Northern Pacific. Cfr. above, p. 128.

Cladoscenium limbatum Jørg. n. sp.
(Pl. XV, fig. 74.)

Resembles to some extent the foregoing species, and is, on the whole, of the same structure, but, is nevertheless, quite different through the following special characteristics:

The main spines are more broadly three-edged, each edge having 2 to 4 diverging spines, which nearest to the shell are often prolongated to arch-shaped fine, supporting branches, between the shell and the main spine. Such arches are only seen from the one or two innermost branches (spines) and most clearly on the upper side of the main spines. Outside the basal arches, perhaps only between the lateral spines, a brim-shaped continuation of the lattice shell is developed. This brim continues a little way forwards along the sides of the main spines.

There is a verticil of branches high up on the columella, as in the foregoing species, but these branches are here almost straight on the distance between the columella and the shell.

The network of the lattice shell is much more perfect than in the foregoing species, most of the meshes being small and more or less distinctly square.

There is a trace of lattice wings from the top horn to the basal spines, and for this reason the species, perhaps, should most correctly be referred to the genus *Pteroscenium* Hck.

The cephalis is 52 μ in height, the width between the lateral spines 56 μ. The right, lateral spine is 68 μ in length outside the shell, the tophorn 50 μ. The stronger, primary arches seem here to become less conspicuous with growing age, so as to make the network more even in development. Finally the pores seem to dis-

appear, being closed by thin plates, so that they are transformed into windows, not openings.

Only two specimens observed: [19]/1 1899, 40 miles NW of Gaukværø, 0—700 m.

Peridium Hck.

Has the four primary spines as well as the ventral, sagittal one.

I have previously (Jørgensen L. 91, p. 75) expressed the opinion that the genus *Peridium* ought most naturally to be placed upside down, with the arched dome (cephalis) downwards and the opening, which is partly closed by lattice work from the basal spines, upwards. It is still my opinion that this is most correct after the analogy with *Campylacantha, Plectacantha* and *Phormacantha.* Here it may be clearly proved that the apical spine in Haeckel's sense corresponds to the dorsal, basal spine D in the genera mentioned. While I, at the same time, considered the genera *Euscenium* and *Cladoscenium* to have apical network in contradistinction to *Peridium* and the group *Plectoidea* Hck. with a basal one, I have later on come to the conclusion, after closer examination, that such a difference does not exist. I have therefore retained Haeckel's method of placing so as not to bring *Peridium* in opposition to the other genera of the group *Cyrtoidea* Hck., for which I prefer from practical reasons, at any rate for the present, to retain Haeckel's method.

P. longispinum Jørg.

(Pl. XV, figs. 75—79; pl. XVI, fig. 80.)

Jørgensen L. 91, p. 75.

I am for the present not quite sure whether or not there are at least two different species included under this name. What makes it still more difficult is that young forms of *Dicyrtida* often have the appearance of a *Peridium,* so that it is necessary to be very careful in the determination.

On older, well developed forms there is a cephalis which is broadest above the middle, then quickly rounded off upwards and conically narrowed downwards. The lattice shell is well developed and closed all round. The pores vary considerably in size, from very small and round to large, oblong and polygonal.

The main spines protrude far out. The very long and very narrow points seem only to occur in younger individuals. Large byspines, strongly bent outwards, are found on the right and left lateral arches. Besides, there are smaller, straight byspines scattered over all the surface of the shell, stronger and fewer in number at the basal opening, numerous and fine, narrow, needle-shaped on the upper side of the cephalis.

Younger individuals (if these do belong to the same species) with larger, more irregular pores, thinner beams, less perfectly developed lattice shell and long and narrow main spines. The cephalis in such forms is generally rounder, and often broader than it is high.

Here again we find the characteristic course of the primary arches, as mentioned under *Plectacantha oikiskos.* The larger secondary meshes and spines, which are mentioned at the same place, are also present here.

Rather rare, in deep water samples, up to 50 m.

Distribution: Also on the west coast of Norway, rare. Occurred too in two surface samples from the warmer, salter Atlantic waters, [2]/3 1901, off Søndmøre, and [5]/3 off Lofoten (cfr. above, under *Cladoscenium tricolpium).*

P. minutum Cl.

Cleve L. 30, p. 31, pl. 3, f. 1 a, b, c.

The forms which I have referred to this species, occurred rarely in my material. They may at once be distinguished from the preceding species on account of the absence of the numerous, fine byspines on the upper part of the cephalis.

VII C. 5. Dicyrtida Hck.

Lithomelissa Ehrb.

The four primary spines, A, D, L_r and L_l, are present, as well as the ventral, sagittal one.

The apical spine, D, runs in the wall of the cephalis, and protrudes like a needle-shaped tophorn, the lower part being inside the lattice shell. The dorsal, basal spine, A, protrudes obliquely like a simple spike (needle), rather far down on the thorax. On the inside, it is propped up against the shell by arch-shaped supporting beams (corresponding to the apical arches in *Phormacantha hystrix).* The lateral spines pierce the thorax in its upper part and protrude each of them as (one or?) two spikes.

The ventral, sagittal spine protrudes near the region of the neck (between cephalis and thorax), and is, in *Lithomelissa setosa,* connected to the right lateral spine, L_l, by an inner, little lattice-plate, whilst it is farther distant from the left, lateral spine. In other words, it divides the angle between the lateral spines into two very uneven parts, one small one to the right, and a larger one to the left. By this feature, young forms of *Lithomelissa setosa* are easily recognized, even if only the cephalis be developed.

The primary arches between D, L_r and L_l are well developed, and protrude on the inside like three archshaped ledges, running upwards. By means of outwards and downwards bent byspines from these primary arches, together with branches and arches from the dorsal spine, A, and the lateral ones, the thorax is developed. In the upper part of the thorax, there are, therefore, formed three, more or less distinct swellings, a right one, below the primary, right, lateral arch, a left one, below the left, lateral arch, and a ventral one, below the primary, ventral arch.

Here too, as in all the forms of *Cyrtoidea* occurring in my material, there is an inner axial spine, pointing downwards vertically from the ventral end of the central rod, thus having the same starting point as the ventral, sagittal spine.

L. setosa Jørg.

(Pl. XVI, figs. 81—83; pl. XVIII, fig. 108).

Jørgensen L. 91, p. 91, non *Botryopyle setosa* Cl. L. 30, p. 27, pl. 1, f. 10.

Compare above the description of the genus and of the structure of the species in the introduction to the group *Nassellaria.* Cfr. too Jørg. l. c. where a detailed description will be found.

Of byspines, there are usually too strongly developed one on the right, lateral arch, protruding in the form of simple spikes in the upper part of the thorax, one or two similar ones on the left, lateral arch, and a couple on the cephalis.

The spikes, which are seen in varying numbers and differently developed on the lower margin of the thorax are — at any rate most often — only temporary formations. They disappear later on,

as the development of the thorax progresses, the meshes being formed between these spines. Is is possible that var. *belonophora* Jørg. l. c., pl. 4, f. 22, is the fully developed form, and that its marginal spines are therefore permanent.

Frequent, mostly in deep water samples, sometimes — but rarely — in the surface. Rarely at all numerous.

Distribution: Belongs to the most frequent *Radiolaria* on the west coast of Norway.

L. laticeps Jørg. n. sp.
(Pl. XVI, fig. 84).

As yet, I am only imperfectly acquainted with this species which seems related to *L. thoracites* Hck. and *L. mediterranea* J. Müll. It differs from the preceding one in having a larger cephalis, which is broader and more obtuse, and by the want of byspines. Neither does there appear to be any other protruding spines than the principal ones, with perhaps a couple of branches.

The thorax has no marginal byspines beneath. The pores here on the lower margin are larger and the walls thinner, so that probably the individual illustrated is not yet fully developed.

Very rare and only singly: Sea off Røst, $^{22}/_{3}$ 1899, 0—900 m.

Distribution: I have seen it in a deep water sample from the sea between the Færø and Shetland Isles (cfr. above, p. 128).

L. hystrix Jørg.
(Pl. XVI, fig. 85).

Jørgensen L. 91, p. 83.

Cephalis not very high, finally, by the development of secondary, outer arches in the region of the neck, a broad semisphere, which is half of it sunk into the thorax.

The thorax is above campanulate, below cylindrical, with two distinct, lateral indentations in the upper part.

In the region of the neck in younger individuals, there are large holes, which later on are, to some extent, closed, by the development of outer arches between the lower part of the cephalis and the upper part of the thorax. The pores outside this region of the neck are roundish, of very varying size, being smallest on the upper part of the cephalis.

On the whole, there appears to be the same spines as in *L. setosa,* but fewer really protruding ones from the inner skeleton. The thorax here too appears to be similarly formed to that of *L. setosa,* from strong, obliquely downwards pointing byspines on the primary arches. A number of such obliquely protruding byspines are also seen in this species in the region of the neck. In addition, there are also numerous, needle-shaped byspines on the cephalis and the upper part of the thorax, and these, on a broad part of the shell, between the cephalis and thorax, develope fine, connecting beams, covering the large neck openings.

The region of the neck will here, in this way, be surrounded by a covering which causes the cephalis finally to be half (or wholly?) sunk into the thorax. This outer covering is chiefly formed from byspines on secondary arches.

Cephalis 22 μ broad, thorax 45—50 μ broad. The height of the thorax in the forms occurring in my material 34—40 μ. In these forms, which most probably were not fully developed, the brim of the thorax was provided beneath with short irregular spines, which no doubt are the walls of meshes in process of development.

It is a question whether this species should not be more correctly separated from the genus *Lithomelissa.* But as I have not as yet had an opportunity of studying the inner skeleton more carefully, I will, for the present, retain it in the genus in which I originally placed it.

Very rare and occurs only sparsely: $^{19}/_{1}$, 1899, 40 miles NW of Gaukværø, 0—700 m.; $^{28}/_{3}$ 1899, the Tys Fiord I, 0—700 m.

Distribution: Also very rare on the west coast of Norway.

Amphimelissa Jørg. n. gen.

This genus in outward appearance is similar to *Lithomelissa,* but its structure is principally different. It has the most important spines of the *Campylacantha* type, namely the four primary ones, A, D, L_r and L_l, one ventral, sagittal spine, and two strong lateral, dorsal ones, rising from the base of the spine D, which here, as in *Lithomelissa,* appears as a protruding, apical spine. The primary arches too are strongly developed, the ventral arch, namely, as well as the right and left lateral arches (cfr. *Plectacantha)* all as arches inside the cephalis. To these come a couple of strong arches from the dorsal, lateral spines to the primary, lateral arches, also situated inside the cephalis, near its sides.

These strong inner arches are all connected outwards with the lattice shell, by means of strong, supporting beams which, for the most part, protrude on the exterior, as fine, long spikes.

This peculiar form is only distantly related to the others in my material. In structure it is unmistakably similar to *Phormacantha hystrix;* but there are, nevertheless, as far as I have hitherto been able to see, important differences in the structural type. The distinctly enclosed columella (the spine D) is characteristic; it shows, from the dorsal side, two basal, obliquely downwards pointing side branches, the dorsal, lateral spines, and higher up two obliquely upwards pointing ones, the usual primary branches of the spine D. Probably the two strong arches from the dorsal, lateral spines to the right and left, primary, lateral arches correspond to the comparatively strong apical arches, which in *Phormacantha hystrix* extend from the primary branches of the apical spine A to the lateral arches. In this case, the dorsal, lateral spines might be considered to be, centrally displaced, primary branches of the spine A, and this answers to their direction.

The genus *Amphimelissa* then has an inner, incompletely latticed cephalis, surrounded by a lattice shell, which immediately continues downwards as a thorax.

The rather intricate course of these inner arches and skeleton parts here, as in the genera *Lithomelissa* and *Acanthocorys,* is difficult to trace in its details, as the outer lattice shell generally conceals them. So there are in this genus, as in the other two above mentioned, several structural details which require closer investigation. So much is, however, certain, that no satisfactory, natural system of classification for the *Cyrtoidea* group can be formed, unless the necessary consideration is paid to these inner skeleton parts.

The genus *Amphimelissa* ought undoubtedly to be kept distinct from the peculiar, irregular forms which form Haeckel's division *Botryodea.*

A. setosa (CL.) JØRG. n. nom.
(Pl. XVIII, fig. 109).

Botryopyle setosa CL. L. 30, p. 27, pl. 1, fig. 10 a, b.

The transverse section is a short oval, with the longitudinal axis in the direction of the central rod (sagittally). There are three large swellings on the upper part of the shell (the „cephalis"), a dorsal one, between the spines A and D, and two lateral ones on each side extending forwards to the ventral side.

I earlier confounded this species with *Lithomelissa setosa* and it is entered in the tables under this name. It seems however, on the whole, to be very rare. It is interesting that it seems to occur during the spring diatom inflow.

Malangen, $^{29}/_{1}$ 1899, 0—300 m., Lille Molla, $^{1}/_{4}$ 1899, in the surface.

Distribution: Rare on the west coast of Norway. Mentioned by CLEVE from places in the northern and western Atlantic, as far as to the west of Spitzbergen, here at great depths (76°—78° N, 15° E—3° W, deep sea hauls from 325 m. and more, Aug. and Sept. 1898; 71°—72° N, 21—22° W, hauls from 180 m. and more, July 1899; 45° N, 49° W, high salinity and temperature, January 1899).

Acanthocorys umbellifera HCK. (?)
(Pl. XVIII, fig. 107).

HAECKEL L. 84, p. 305, pl. 6, fig. 12.

Under this name I have entered a form which has the appearance of a species of the division *Dicyrtida,* but is certainly not fully developed. It is remarkable, as also HAECKEL's illustration, for a rather large cephalis and a short, broad thorax. The spines in the thorax, protruding from the free brim like long, fine spikes are characteristic. Some of these spines are weaker than the others and are branches of them. The cephalis is well supplied with long, needleshaped byspines. There is also a similar apical spine, which here, as in *Lithomelissa,* is the spine D and runs in the wall of the cephalis, thus not forming any inner columella.

My species differs from HAECKEL's only in the want of byspines on the thorax.

This species occurred very rarely and sparsely in the material from the northern coasts of Norway: $^{19}/_{1}$ 1899, 40 miles NW of Gaukværø, 0—700 m.; $^{29}/_{1}$ 1899, Malangen, 0—300 m.

Distribution: More frequent on the west coast of Norway, numerous in the Oster Fiord, near Bergen, at a great depth (up to 600 m.), $^{13}/_{6}$ 1900.

CLEVE mentions the species from a few places in the Atlantic, west of Ireland and more to the south, as well as from several places far north, to the north west point of Spitzbergen. In these northern places, the species was only found in deep water. HAECKEL mentions it from the Azores and the Mediterranean. Hence CLEVE considers the species to belong to Styliplankton. It seems, however, judging from the places mentioned where it has been found, to have about the same distribution as *Plectacantha,* and is probably boreal oceanic.

It is, however, quite possible that HAECKEL's is a distinct species.

Helotholus JØRG. n. gen.

The four primary spines with the ventral, sagittal one. All five protrude as single spikes, the dorsal one, A, down on the thorax, the ventral, sagittal one in the neck stricture, the one marked D, on the cephalis as an apical spine.

The lower part of this latter spine is inside the wall of the cephalis, while it a little higher up runs in the very wall. It is therefore no genuine columella.

There is also an axial spine, as in the other species here mentioned of the *Cyrtoidea* group. This axial spine starts as usual from the ventral end of the central rod, in the interior of the lattice shell, a little below the neck stricture, and is in elder individuals of *Helotholus histricosa* divided in two.

The thorax is broadly campanulate, nearly semispherical.

H. histricosa JØRG. n. sp.
(Pl. XVI, figs. 86—88).

The ventral sagittal spine about equal in strength to the others and is directed a little upwards. The primary, lateral spines are nearly horizontal, bent slightly downwards; they protrude at the neck stricture, rather far up. The dorsal spine, A, is directed downwards and pierces the thorax rather far down.

Only the dorsal spine, A, runs for a short distance in the very wall of the thorax, the others pierce only the wall.

The cephalis is semispherical, or a little higher, in cross section circular. The thorax is broadly campanulate.

The pores are irregular in shape and size, most of them being roundish or oblong, smallest on the cephalis (1—16 μ), largest on the thorax, especially down below on young individuals. Here the brim of the thorax is furnished with numerous, irregularly placed, short spines, which are not true byspines, but only the walls of meshes which are not yet developed.

On the cephalis and thorax, narrow needle shaped byspines are scattered, the longest being about equal in length to the diameter of the cephalis.

I have not seen any individuals which could be supposed to be fully developed.

The species does not answer well to any of HAECKEL's genera. From the genus *Lithomelissa,* as I have understood it in the species *L. setosa,* there are such important differences that it does not seem reasonable to place these two forms in the same genus. It might rather be united with the following species. I have not, however, done so, more especially as the definition of HAECKEL's genus *Dictyophimus* requires that there should be three thoracic ribs which are lengthened out to „basal feet", and this definition may at a pinch be made to apply to the two following species, but not at all to *Helotholus histricosa.*

Rather rare, sparse, in deep water samples.

Distribution: Seems also to be a boreal, oceanic species.

Dictyophimus EHRB., HCK.

This genus is by HAECKEL made to include rather highly differentiated forms, which probably ought to be kept distinct from the species which I have here referred to it. There does not, however, appear to be any great disadvantage in placing them here preliminarily.

From these two species, the genus should be defined as follows:

The four primary spines are present, as well as the ventral, sagittal one. The three basal ones (L_r, L_l and A) extend from the central rod to the upper part of the thorax, a little below

the neck, hence running for a little way in the thoracic wall, and then protruding either as thoracic „feet" *(D. histricosus)*, or leaving the thorax above its free brim.

The thorax is broadly campanulate or conical.

D. Clevei Jörg.

D. gracilipes Cl. L. 30, p. 29, pl. 2, f. 2, vix Bail. *D. Clevei* Jörg. L. 91, p. 80, pl. 5, f. 26.

The protruding part of all five spines of uniform breadth, much broader than the inside part, with three distinct edges. In young specimens, the three basal spines extend from the lower part of the thorax. They are partly running in the thorax, but on older individuals always appear to protrude above the free brim.

The irregular, small spines on the free brim of the thorax are here, as in the preceding species, only temporary formations, which later on become intermediate walls between new meshes.

In the passage from the cephalis to the thorax, there are three distinct swellings, two lateral, outside the primary, lateral arches (B_r and B_l), as well as a ventral one between the primary, lateral spines.

The thorax is wide, flatly campanulate.

Dictyophimus gracilipes Bail. (L. 9, p. 4, pl. 1, f. 8) does not appear from the description to be this species („triquetrous; three acute ridges prolonged into long acute basal spines").

Rare, in deep water samples.

Distribution: Rare on the west coast of Norway. Cleve mentions *D. gracilipes* from a few places in the northern part of the Atlantic up to the north west point of Spitzbergen, at the most northern places only in deep water. Bailey's species was found in the Northern Pacific and Kamtschatka.

Probably boreal oceanic.

D. histricosus Jörg. n. sp.
(Pl. XVI, fig. 89).

Cephalis semispherical, thorax pyramidal.

The basal spines extend from the central rod (under the neck stricture) to the thorax and continue in the thoracic wall to the very margin below where they protrude as „basal feet". The apical spine, D, runs chiefly in the wall of the cephalis (as in the two preceding species) and above is prolongated to a tophorn, which is only very little different to the byspines in appearance. This is also the case with the ventral, sagittal spine, which runs obliquely upwards and out through the neck stricture.

All the main spines are narrow, not three-edged.

Cephalis and thorax rather plentifully provided with narrow, needle-shaped byspines, which are longest and most numerous on the cephalis. The longest are as long, or even a little longer, than the diameter of the cephalis.

The pores are uneven in shape and size, varying from quite small to 9 μ, not much smaller on the cephalis than on the thorax.

Here too the three swellings on the upper part of the thorax between the main spines (fig. 89 b) are to be found.

The width of the lattice shell is 85 μ, its height (not including the basal feet) 68 μ. The cephalis alone is 34 μ wide and 22 μ high.

Very rare and only singly: $^{19}/_1$ 1899, 40 miles NW of Gaukværø, 0—700 m.; Henningsvær, $^{21}/_2$ 1899, 0—250 m.

Distribution: Probably boreal oceanic.

Litharachnium Hck.

Rudimentary cephalis. In the neck stricture, which here is near the top of the lattice shell, the three primary meshes will be seen between the three primary, basal spines. These spines are here very much retrograded and have only the appearance of walls between the primary meshes. Both the apical spine, D, and the ventral, sagittal one are wanting. Refer for further details to Hck. L. 84, p. 1163.

Young forms of *Litharachnium tentorium* will appear as slender pyramids and thus correspond to the genus *Plectopyramis* Hck.

Haeckel mentions and illustrates the three primary meshes mentioned (his cortinar septum) but no cephalis. He too considers, however, the jointless lattice shell to be the thorax, as he definitely derives the genus from *Dicyrtida* by the loss of the cephalis.

My opinion therefore is that it would be most natural to refer all the genera belonging here to *Dicyrtida,* not to *Monocyrtida.* In this species (and probably in most cases) a rudimentary cephalis is also distinctly visible.

The genera which belong here according to Haeckel ought undoubtedly to be subjected to revision.

L. tentorium Hck.
(Pl. XVI, figs. 90—91).

Haeckel L. 84, p. 281, pl. 4, figs. 7—10, L. 86, p. 1163.

The upper part of the lattice shell is slenderly conical, widened out below to a broad brim which is at the outside edge bent again upwards, giving the appearance of the brim of a hat. At the top of the conical part, there is a tiny semispherical cephalis.

The pores in the upper part of the shell are small, round and scattered; farther down they are lattice windows (as in the genus *Plectopyramis* Hck.) and are more regularly arranged in horizontal rows. The shape gradually lengthens out horizontally, so that from being round they become rectangular with rounded corners. Only still farther down do the straight ribs in the wall of the lattice shell appear, and the pores now become regularly rectangular, and are arranged in distinct rows, both radially and tangentially. When the radial pores have attained a certain size, new straight longitudinal ribs appear in the wall of the lattice shell, pushed in between the old ones.

The number of principal ribs in the well developed specimen which is illustrated in fig. 90, was 32. Very numerous secondary ribs, their number increasing in proportion to the distance from the cephalis, were present between these 32. The diameter of the brim 340 μ, of the cephalis only 8—9 μ. The largest meshes (high up) 9 μ, in the brim about 6 μ.

Notwithstanding that there are really great differences in Haeckel's and my descriptions, it seems — on account of the remarkable correspondence in so many details with Haeckel's illustration — that my species and Haeckel's are after all identical.

This species answers perhaps best in structure to the many-jointed genera (division *Stichocyrtida),* and might be considered as such a many-jointed form, where the strictures and annular septa between the different joints have disappeared.

Very rare, only singly: Skroven, $^4/_4$ 1899, 0—150 m.; the Folden Fiord, $^6/_4$ 1900, 300—200 m.

Distribution: In the sea between Norway and the Faeroe

Isles (also mentioned from here by CLEVE, L. 40). Found by HAECKEL at Messina.

Seems to be a southern, temperate, oceanic form.

Androcyclas JÖRG. n. gen.

The four primary spines and the ventral sagittal one are present. The apical spine, D, runs close to the cephalic wall, and finally protrudes as a marginal topsword, thick and large, and furnished with three broad edges. There is, consequently, no distinct columella.

The three basal spines, A, L_r and L_l protrude from the upper part of the thorax (the spine A lowest down) like fine needles, which pierce the wall, no part of them being enclosed in it as „thoracic ribs". The ventral, sagittal spine also protrudes like a similar needle in the region of the neck.

There is also a long, inner axial spine, which reaches as far down as to the upper part of the abdomen.

Cfr. the remarks about the region of the neck, under the description of the species.

I referred the following species previously to the genus *Pterocorys* HCK., but I now find it necessary to separate it from this genus which has strong side swords on the thorax.

On the other hand, there is probably no doubt that the genus *Theoconus* HCK. to some extent corresponds to my genus *Androcyclas*. Thus, *Theoconus jovis* HCK. (L. 86, pl. 69, f. 4) is undoubtedly of quite the same structure as *Androcyclas gamphonycha*, the byspines on the abdomen of the latter only excepted. As, however, HAECKEL's group *Theocyrtida*, to which *Theoconus* HCK. and *Theocalyptra* HCK. belong, is defined as *Tricyrtida* without radial apophyses, I have thought it most practical, to avoid confusion, temporarily to erect the new genus *Androcyclas*.

A. gamphonycha (JÖRG.)
(Pl. XVII, figs. 92—97).

Pterocorys gamphonyxos JÖRG. L. 91, p. 86.

P. theoconus JÖRG. l. c. *P. amblycephalis* JÖRG. l. c.

The region of the neck is very peculiar, not forming any distinct stricture between the cephalis and thorax, but a zone where these two joints gradually pass into each other. This region appears on the dorsal side to lie between two pair of branches from the apical spine, D, namely two dorsal, lateral spines below (corresponding to those in the genus *Amphimelissa)* and the primary, lateral arches above. These dorsal, lateral spines (from the base of the spine A and the spine D) lie near the hind wall of the cephalis. The lower part of the apical spine, D, is here a columella in the region of the neck, but lying near the cephalic wall.

The length of the abdomen varies considerably, probably according to age; this is also the case with the number of byspines. It is not unusual to find comparatively well developed forms which are apparently almost or entirely without the characteristic byspines, but which in other respects diverge so little from the typical forms that they can scarcely be considered to belong to any other species. Therefore I now think that *Pterocorys theoconus* must be looked upon as a form of this species.

The other, very short tophorn is very rarely seen distinctly and is probably a more or less accidental formation. Sometimes strong siliceous edgings are developed on the upper part of the cephalis, and these may be protruding and in certain positions look like a very broad, short spine.

According to my experience no limit either can be drawn between *Pterocorys gamphonyxos* and *P. amblycephalis*. The younger forms seem to answer best to the latter, which is in appearance so different to *P. gamphonyxos* that it is generally easy to keep them distinct. (This is done in the tables). The principal difference is that *P. amblycephalis* has a cephalis which is at the upper part abruptly cut off and, at the very top, often open. This opening is probably closed later on. The tophorn is generally shorter and more weakly developed and the abdomen short and broad, without distinct byspines, all characteristics which may be explained by supposing that *P. amblycephalis* is the younger stage of development. On inviduals which it seemed more correct to refer to *P. amblycephalis* than to *P. gamphonyxos*, I have also occasionally seen short and broad byspines in conjunction with a better development of the abdomen.

On the best developed specimens of *A. gamphonycha*, the abdomen is again narrowed below, the strongest set of spines being on that part which is broadest. The byspines are only slightly bent.

Frequent, in Tranødybet $^6/_4$ 1899, 0—630 m., numerous, otherwise rather sparse and generally only in deep water.

Distribution: On the west coast of Norway, in deep water, rare. Off the coast of Finmark $^5/_3$ 1901, in a surface sample (S/S Michael Sars cfr. GRAN, L. 70, p. 154). Perhaps a temperate oceanic form.

Clathrocyclas ***craspedota*** (JÖRG.) JÖRG.
(Pl. XVII, figs. 98—100).

Theocalyptra craspedota JÖRG. L. 91, p. 85.

The abdomen is a narrow, flat, projecting brim, on well developed specimens having two or three regular, circular rows of meshes, the inner row with small pores. The free side-walls of a ring of meshes under development will have the appearance of a regular circle of short, radial spines on the abdominal brim.

The same spines are present as in the preceding genus. The three basal spines protrude similarly as fine needles in the upper part of the thorax (the dorsal spine, A, farther down than the others). The apical spine, D, also here protrudes with a broad three-edged topsword directed upwards and somewhat backwards. The ventral, sagittal spine protrudes upwards and forwards (ventrally) with a similar, three-edged topsword, which is, however, a little smaller and points obliquely forwards.

Refer for further details to JÖRGENSEN, l. c.

As the incompletely developed abdomen often exhibits a marginal brim of regular, short spines like those HAECKEL draws for species of the genus *Clathrocyclas*, subgenus *Clathrocycloma* HCK. (L. 86, pls. 58, 59), I have thought it best to refer my species to this genus where it seems to have its natural place. In doing so, I also think that *Clathrocycloma* HCK. will be found to have the three basal spines protruding from the upper part of the thorax like fine needles.

If these needles are overlooked or absent, and no notice is taken of the spines on the brim of the abdomen, the species according to HAECKEL's system will be a *Theocalyptra*.

Halicalyptra ? cornuta BAIL. = *Theocalyptra c.* HAECKEL is quite impossible to determine from the very imperfect illustration,

given by Bailey. After this drawing it has only cephalis and thorax.

Frequent, though never numerous.

Distribution: On the west coast of Norway, very rare. In surface samples $^{2}/_{2}$ 1901, off Søndmøre, and $^{13}/_{2}$ off Lofoten (cfr. above under *Cladoscenium tricolpium*, p. 134).

If this species be Cleve's *Theocalyptra cornuta*, it has been found at great depths at some places in the North Atlantic right up to the north west coast of Spitzbergen, and at scattered places in the western part of the North Atlantic. Most probably boreal oceanic.

Dictyoceras Hck.

D. acanthicum Jörg.

(Pl. XVII, fig. 101 a; pl. XVIII, fig. 101 b).

Jörgensen L. 91, p. 84.

It appears very doubtful whether this species really is specifically different from the following one.

The only difference appears to be in the protruding basal spines, which in this species are little more strongly developed outside than inside the lattice shell, while they are transformed into three-edged swords in *D. xiphephorum*. I retain, however, *D. acanthicum* preliminarily as a separate species, as it is, generally speaking, easy to keep it distinct from *D. xiphephorum*. If they should prove to belong to the same species, *D. acanthicum* would be the younger stage.

Rather rare, always in deep water samples, sparse.

Distribution: On the west coast of Norway rare. In surface samples $^{13}/_{2}$ 1901, off Lofoten, and $^{5}/_{3}$ off Finmarken (S/S Michael Sars, cfr. above).

D. xiphephorum Jörg.

Jörgensen L. 91, p. 84, pl. V, f. 25.

Distribution: Like the preceding one. $^{2}/_{2}$ 1901, off Søndmøre, in the surface (S/S Michael Sars, cfr. above).

Stichocorys seriata (Jörg.)

(Pl. XVIII, figs. 102—104).

Eucyrtidium seriatum Jörg. in Gran L. 70, p. 150 (nomen nudum).

A many-jointed form. The uppermost joints are convex and increase in size so that the diameter of the fifth is from three to four times as great as that of the first. The lower part is more or less distinctly cylindrical. On the cephalis, there is a short broad tophorn. The pores below are roundish rectangular, in very distinct, regular, horizontal rows.

The number of the joints varies, probably according to age. Uppermost there is a low, semispherical (or broader) cephalis, then short joints, which increase evenly in width up to the fourth or fifth, which is usually the broadest. From the sixth joint, which is decidedly narrower, the width decreases, but very slowly, so that the lower part is almost cylindrical, only a little narrower below. I have not seen more than eight joints. These lower joints in the cylindrical part are not plainly divided off from each other.

The upper part of the shell is shaped like a high cone.

There is a short, broad, three-edged (?) tophorn protruding from an inner skeleton in the two upper joints.

It is not easy to see these inner skeleton parts which are, at all events, in a high degree retrograded, for it is a difficult matter to examine the shell from the open end, and the outer lattice shell in side view hides the short, primary spines. So I have not been able definitely to decide whether this genus has the same primary skeleton parts as the foregoing ones. Neither have I been sure if protruding basal spines exist in the two upper joints (the apical spine only excepted).

The shape of the cephalis in some positions of the lattice shell might suggest that also inner primary arches are to be found, and not only the primary spines.

It is doubtful whether there is a protruding ventral, sagittal spine.

On the other hand, a long, inner axial spine is plainly visible. It seems to consist of three or more long, parallel branches, which reach down through more than half the length of the lattice shell.

The central capsule also reaches far down through the shell.

The pores on the cephalis are small, round, widely apart and scattered. On the second joint, they are perhaps a little larger, on the third somewhat smaller again, and from here they are regularly placed in horizontal rows. From the fourth joint and downwards, the pores become more irregular in form and size, from quite small and round to rather large, roundish rectangular in shape, although generally speaking they are small and always in regular, horizontal rows. On the cylindrical lower part, they are also placed in more irregular vertical rows. The average size of the pores does not increase, at any rate noticeably, from the fourth joint d wnwards.

This species varies rather considerably. For instance, its greatest width may be either in the fourth or fifth joint, and there are often irregular contractions in the lower part. It is doubtful whether any of the individuals illustrated are fully developed. On the best developed specimen (fig. 102) the lower margin was regularly dentate. Often young individuals may be found consisting of only a few joints and entirely without the cylindrical lower part.

Height, up to 128 μ, greatest width 72 μ. Pores, up to 6 μ.

The species resembles the one illustrated by Cleve, L. 30, pl. 2, figs. 5 and 6, which he calls *Lithomitra australis* Ehrb. It is probable that the same basal spines are present in this species, protruding as fine needles, as in *Androcyclas gamphonycha* and *Clathrocyclas craspedota*. Even if these spines are present, Haeckel's name for the genus might in this case be retained without any great disadvantage.

Rather rare, always in small numbers and only in deep water samples.

Distribution: In surface samples, $^{2}/_{2}$ 1901, off Søndmøre, $^{13}/_{2}$ off Lofoten and $^{5}/_{3}$ off Finmark (cfr. above).

Most probably a boreal oceanic species.

VII D. Phaeodaria Hck. (Tripylea).

VII D. 1. Cannosphaerida Hck.

Cannosphæra Hck.

C. geometrica Borg.

Borgert L. 12, pl. 6, f. 6; L. 14, p. 25, f. 25.

This species is smaller, but more robust than the following.

Specimens which seem to belong here were found very sparsely in the plankton of 1899 from the following places:

In the sea 40 miles NW of Gaukværø, 19/1, 0—700 m.; Kvænangen I, 24/1, 0—140 m.; the Vest Fiord 1/2, 0—200 m.; Skroven 1/2, 0—300 m. The species appears with us only to occur in deep water.

Distribution: Hitherto only found in the Irminger Sea, south west of Iceland, n. lat. 60° 3′, w. long. 27° (Borgert, l. c.). Certainly an oceanic form, perhaps from the northern part of the Gulf Stream.

C. lepta Jörg.

(Pl. XVIII, fig. 110).

Jörgensen, L. 91, p. 89.

Is a larger, weaker species. There is particularly great divergence in the radial beams, which in this species are generally thin threads, while in the foregoing one, they are strong, thick beams. The species varies, however, considerably. As a rule only broken species are found, as it is easily destroyed on being touched.

Was very rare and sparse in the samples of 1899, in 1900, on the contrary, not unusual. Generally only in deep water, yet up to 50 m.

Distribution: Previously only known from the west coast of Norway, but not rare here in 1898, though always in small numbers.

VII D. 2. Challengerida Hck.

Protocystis Wall. (*Challengeria* Murr.).

P. xiphodon (Hck.) Borg.

Challengeria xiphodon Hck. *Protocystis xiphodon* (Hck.) Borgert L. 14, p. 27—28, f. 28.

Rather frequent, but always sparse. Always in deep water samples.

Distribution: A temperate oceanic species, distributed from the tropical part of the Atlantic to the north coast of Iceland (Cleve, L. 40, p. 147). On the west coast of Norway, very rare (1898). In the North Sea at several places in deeper water in May and August 1903, especially in the northern opening towards the Norwegian Ocean (L. 18, 1903—1904, nr. 1). According to Borgert l. c. also known from the East and the West Greenland Current, the Labrador Current and the Mediterranean.

P. Harstoni (Murr.) Borg.

Borgert L. 14, p. 28, f. 30. *Challengeria Harstoni* Murr., cfr. Jörgensen L. 91, p. 90.

Rare and sparse, always in deep water.

Distribution: On the west coast of Norway also rare, in deep water. Also found in the northern part of the Gulf Stream at a few places, up to south and west of Spitzbergen, also in deep water.

Is probably an oceanic species, perhaps boreal, or at any rate belonging to the northern part of the Gulf Stream. Also found in the northern part of the Pacific, at great depths.

P. tridens (Hck.) Borg.

Borgert L. 14, p. 29, f. 32. *Challengeria tridens* Hck., cfr. Jörgensen L. 91, p. 90.

Frequent, though never numerous, as a rule only in deep water, up to 50 m.

Distribution: Frequent on the west coast of Norway, in August 1903 in large numbers in deep water off the coast of Bergen (L. 18, 1903—1904, nr. 1).

Also found many places in the North Sea and the northern part of the Gulf Stream, as far as south and west of Spitzbergen. According to Borgert l. c. also known from the East and the West Greenland Current and the Labrador Current. Probably a northern temperate oceanic form.

Challengeron *diodon* Hck.

Borgert L. 14, p. 30, f. 34. Cfr. Jørgensen L. 91, p. 91. *Challengeron heteracanthum* Jørg. l. c.

On more weakly developed (probably young) specimens, the characteristic byspines are wanting. It is therefore centainly most practical to do as Borgert has done and consider as one species, *Challengeron diodon, C. heteracanthum* and *C. Nathorsti* Cl.

Not particularly frequent and as a rule very sparse, always in deep water.

Distribution: On the west coast of Norway, frequent, but always sparse. Found at a few places in the North Sea (May 1903 at a great depth, according to L. 18) and the northern part of the Atlantic up to the west of Spitzbergen, in deep water. According to Borgert l. c. also found in the Labrador Current, the more southerly part of the Atlantic and in the Mediterranean. According to Haeckel, *Challengeron diodon* has been found in the south eastern part of the Pacific, at a great depth.

C. Channeri (Murr.) Hck.

(Pl. XVIII, fig. 111).

Challengeria Channeri Murray L. 106, p. 226, pl. A, fig. 12. *Challengeron Channeri* (Murr.) Hck. L. 86, p. 1658. Borgert L. 14, p. 32, f. 38.

I have only seen one individual which I have supposed to belong to this species. Its shell was circular in outline, strongly compressed, with 16 marginal spines, all more or less broken off. Also the teeth of the peristome were broken off.

Diameter, 165 μ.

In the sea 40 miles NW of Gaukværø, 19/1 1899, 0—700 m.

Distribution: In the sea south west of the Faeroe Isles, and the southern parts of the Atlantic (Borgert l. c.). On the American side of the Atlantic (48° n., 42° w. according to Cleve L. 40, p. 147, very rare). The Northern Pacific, at a great depth (Haeckel l. c.).

C. armatum Borg.

(Pl. XVIII, fig. 112).

Borgert L· 14, p. 33, f. 39. *C. Willemoesii* Hck. L. 86, p. 1659, pl. 99, f. 13?

Only one individual observed, this one also from the sea 40 miles NW of Gaukværø, 19/1 1899, 0—700 m. Unfortunately I missed this specimen before I had finished my examination and drawing of it.

Distribution: Northern branch of the Gulf Stream and the more southerly parts of the Atlantic, according to BORGERT l. c. According to L. 18, 1903—1904, nr. 1, also west of the Faeroe Isles, August 1903, in deeper water, r.

VII D. 3. Medusettida HCK.

Medusetta ***arcifera*** JØRG.

JØRGENSEN L. 91, p. 93, pl. 4, f. 23.

Closely related to *M. parthenopœa* BORG. L. 13, p. 243, pl. 11, f. 5.

Very rare and only singly, 1899: Henningsvær $^{17}/_{1}$, 0—100 m.; Senjen $^{21}/_{1}$, 0—130 m; Ofoten II, $^{7}/_{2}$, 250—200 m.; Reine $^{27}/_{3}$, 0—150 m. Only in deep water.

Distribution: Further, only known from the west coast of Norway, where it is not so rare. Most probably a temperate form.

The closely allied species, *M. parthenopœa* BORG., is found at Naples.

Gazelletta ***pentapodium*** JØRG.

JØRGENSEN L. 91, p. 94.

Very rare and only singly, 1899: Moskenstrømmen $^{14}/_{1}$, 0—50 m.; Senjen $^{21}/_{1}$, 0—50 m.; the Vest Fiord $^{1}/_{2}$, 0—200 m.; Henningsvær $^{20}/_{3}$, 0—280 m.

Distribution: Same as the preceding.

VII D. 4. Cadiida BORG.

Cadium ***melo*** (CL.) BORG.
(Pl. XVIII, fig. 118).

BORGERT L. 14, p. 50, f. 58. *Beroetta melo* CL. L. 30, p. 27, pl. 1, f. 8. Cfr. JØRGENSEN L. 91, p. 92.

Only one specimen noticed: Sea off Røst, 60 miles NW of Røst, $^{22}/_{3}$ 1899, 0—900 m.

Distribution: Seems to be an oceanic form from the northern part of the Atlantic. Only found alive in the By Fiord at Bergen (JØRGENSEN L. 91, p. 93), 0—200 m., rr, and at a great depth west of Spitzbergen (CLEVE l. c.).

VIII. Tintinnodea.

Tintinnus ***acuminatus*** CLAP. et LACHM.

Cfr. JØRGENSEN L. 90, p. 8, and pp. 42—43.

Frequent, but always in small numbers. Seems to be most frequent in rather deep water (which is warmer and has a higher degree of salinity).

Distribution: Seems to be an oceanic form from the Northern Atlantic, perhaps also neritic, temperate and boreal. According to CLEVE (L. 40, p. 121) it has its „principal area of distribution in the Irminger Sea“.

Var. undata JØRG. L. 91, p. 95.

Very sparse in three samples: Helligvær $^{12}/_{1}$ 1899, 0—50 m. and 0—250 m.; Malangen $^{29}/_{1}$ 1899, 0—300 m.

Leprotintinnus ***pellucidus*** (CL.) JØRG.
(Pl. XVIII, fig. 114).

JØRGENSEN L. 92, p. 18. *Tintinnus pellucidus* CL. L. 30, p. 24, pl. 1, f. 4. *Tintinnus bottnicus* BRANDT L. 16, p. 53, pl. 3, f. 11, non NORDQUIST L. 110, p. 126, f. 5. *Leprotintinnus bottnicus* (NORDQ.) JØRG. L. 90, p. 10.

Concerning CLEVE's remark (L. 40, p. 123) as to the correctness of the genus name *Leprotintinnus,* reference should be made to JØRGENSEN L. 92, p. 19.

I have seen individuals with very few foreign bodies on their houses, but I have never seen perfectly smooth specimens. It is however very seldom that one meets with such well covered individuals as the one represented in figure 114.

Very rare and sparse, only found in three samples: Rombaken I, $^{8}/_{2}$ 1899, 0—40 m.; the Øgs Fiord I, $^{14}/_{3}$ 1899 0—90 m.; the Skjerstad Fiord IV, $^{2}/_{4}$ 1900, 0—330 m.

Distribution: On the west coast of Norway, very rare. Also found near Greenland, Spitzbergen and the Arctic Ocean north of Finland (August 1903, occasionally numerous, according to L. 18, 1903—1904, nr. 1). The species is, therefore, certainly a northern one, perhaps boreal oceanic and neritic arctic.

Amphorella DADAY.

A. quadrilineata (CLAP. et LACHM.) JØRG.

Cfr. JØRGENSEN L. 90, p. 12.

It is highly probable that CLAPARÈDE's species, *Tintinnus amphora,* is the same one as is in the same work mentioned as *T. quadrilineatus.* The latter name must, however, be looked upon as the safer. It ought to be preferred if it were not for the complication caused by the use of the name *Tintinnus amphora (Amphorella amphora)* by ENTZ and DADAY for the species here being considered, and by the use of the other name by DADAY in another sense (= *A. Dadayi* JØRG.). Under these circumstances, it would, after all, perhaps be better to use the name *A. amphora* (CLAP. et LACHM.) ENTZ, as CLEVE does (L. 40, p. 99).

Only found in one sample, sparse: Henningsvær $^{17}/_{1}$ 1899, 0—50 m.

Distribution: On the west coast of Norway, rare and sparse. According to CLEVE (L. 40, p. 99) widely distributed in the eastern part of the Atlantic from the tropical zone to Iceland. Also known from the Mediterranean. Is undoubtedly a southern (tropic and) temperate oceanic form.

A. Steenstrupii (CLAP. et LACHM.) DAD.

Cfr. JØRGENSEN L. 90, p. 15.

Also only once found, in small numbers: The Vest Fiord I, $^{13}/_{1}$ 1899, 0—50 m.

Distribution: On the west coast of Norway, rather rare. Undoubtedly, a temperate, southern, oceanic form. According to CLEVE (L. 40, p. 100) the species is widely distributed across the whole of the Atlantic, especially between 40° and 50° N. Also known from the Mediterranean.

A. ampla JØRG.

JØRGENSEN L. 90, p. 17, pl. 1, f. 4, a, b.

Very rare and scarce, only in 2 samples: Henningsvær $^{17}/_{1}$ 1899, 0—180 m.; the Vest Fiord, $^{1}/_{2}$ 1899, 0—200 m.

Distribution: Only known from the west coast of Norway, where it is very rare. Probably a temperate, oceanic species.

Tintinnopsis Stein.

T. nitida Brandt.

Brandt L. 16, p. 58, pl. 3, f. 1.

Very frequent, often numerous. Seems to prefer water of a low salinity.

The species varies considerably. I have to some extent in the tables made a distinction for one form, viz. *var. ovalis,* which is, however, more frequent than would appear from them.

Distribution: Further, only known from the Karajak Fiord, Greenland. Most probably an arctic, neritic species.

Var. ovalis Jørg. n. var.
(Pl. XVIII, fig. 115).

The house is brimless, in the most distinguished form narrowed towards the mouth. The lower part is evenly rounded off. The greatest breadth of the house is a little above the middle.

A strong, compact covering of shining small particles on the house, as in the main species.

This variety is more frequent than appears from the tables, as it is mostly included under the principal species.

Often forms may be found which are intermediate between this one and the main species; such an one is illustrated by Brandt l. c. As a rule, the principal species is very different in shape from the variety, through a trace of a brim at the mouth, an almost cylindrical upper part and a bluntly pointed lower part. Forms without any trace of a brim at the mouth are, however, of frequent occurrence.

The Norwegian species seems generally to be somewhat smaller than the Greenland one, about 70 μ in length.

Var. sinuata Brandt.
(Pl. XVIII, fig. 116).

Tintinnopsis sinuata Brandt L. 16, p. 58, pl. 3, fig. 2.

Considering that the species *Tintinnopsis nitida* varies exceedingly, I think that is hardly possible to look upon *T. sinuata* as a distinct species. In the course of development both the spreading brim at the mouth and the shape of the house vary considerably. We have as extremes, on the one hand, *var. ovalis,* without a brim, or with only a very indistinct one, and an evenly arched contour in side view; on the other, *var. sinuata,* with a distinct brim and a contour which is narrowed in the lower part and bluntly pointed (at the end square).

The individual illustrated, which must undoubtedly be reckoned as a *Tintinnopsis sinuata* Brandt, is not so conspicuously different from *T. nitida* as Brandt's figure, but the characteristics are plainly seen which are mentioned as separating between *T. sinuata* and *T. nitida.* Intermediate forms between the one illustrated and the principal form also occur.

Distribution: As the principal species. Individuals which decidedly belong here were only seen in one of the samples: Moskenstrømmen, $^{14}/_{1}$ 1899, 0—100 m.

T. campanula (Ehrb.) Dad.

Cfr. Jørgensen L. 90, p. 21 and p. 42.

Only in two samples and only singly, 1900: Tranødybet $^{22}/_{3}$, 0—600 m. and the Skjærstad Fiord II $^{2}/_{4}$, 0—180 m.

Distribution: Frequent on the west coast of Norway, but seldom numerous. Also known from the Mediterranean, the North Sea, Skagerack, the Baltic and the Bermudas. In August 1903, numerous in the English Channel (L. 18, 1903—1904, nr. 1). According to Cleve, it is hardly found in the open sea. Undoubtedly a temperate, neritic species.

Codonella Hck.

C. ventricosa (Clap. et Lachm.) Fol.

Only once observed: Tranødybet $^{22}/_{3}$ 1900, 0—600 m., rr.

Distribution: Neritic species, northern temperate. Probably the southern form (from the Mediterranean) is different from the northern one.

C. lagenula (Clap. et Lachm.) Entz. *var. ovata* Jørg.
(Pl. XVIII, fig. 117).

Is probably specifically different from the species which is considered to be the main one.

Rare and scarce.

Distribution: Frequent on the west coast of Norway, but always in small numbers. Most probably a temperate form. The principal species, which is very rare in the neighbourhood of Bergen, is, according to Cleve (L. 40, p. 103) a tropical and southern temperate oceanic form.

Ptychocylis urnula (Clap. et Lachm.) Brandt.

Cfr. Jørgensen L. 90, p. 18.

The principal form (*α major* Jørg. l. c.) not frequent, always in small numbers.

Distribution: More frequent on the west coast of Norway. Neritic form, which appears to be less northerly than the following.

v. minor Jørg.

Jørgensen l. c., p. 19, pl. 1, f. 9.

Frequent, sometimes numerous.

Distribution: Most probably a northern temperate and boreal, neritic species. Is found all the year round, more or less numerous, on the west coast of Norway.

v. digitalis Auriv.

P. Drygalskii Brandt L. 16, p. 59, pl. 3, f. 14. Cfr. Jørgensen L. 92, p. 17.

Very rare and scarce, 1899: The Vest Fiord I, $^{13}/_{1}$, 0—180 m.; Ofoten II, $^{7}/_{2}$, 0—100 m. and 250—200 m.; Rombaken, $^{8}/_{2}$, 0—40 m.; Rombaken II, $^{8}/_{2}$, 0—100 m.; Tranødybet, $^{16}/_{3}$, 0—50 m.; Henningsvær, $^{20}/_{3}$, 0—280 m.; Høla, Svolvær, $^{5}/_{5}$, 0—150 m.

Distribution: Seems to be an arctic neritic and (boreal?) oceanic form. Known from Greenland, the Labrador Current, Jan Mayen and the sea between Jan Mayen and Tromsø. The closely related *P. obtusa* Brandt, which is considered by Cleve also to

include *P. Drygalskii,* is also an arctic form, which has been found at several places near Spitzbergen and Greenland.

v. subarctica Jørg. n. var.
(Pl. XVIII, fig. 118).

The house is broadest at the foremost thickened ring, which is very prominent. The width at the second ring is a little less, decreasing evenly and gradually to the third ring. Behind this, it becomes quickly rounded off nearly spherically (though slightly narrowed off conically nearest the last ring). The wall is very much thickened at the foremost ring. The distance between this and the next ring is equal to, or a little less than, the half of the distance between the two last (so that the two foremost rings are comparatively near each other).

Teeth small, about 36—40.

Length (of the individual illustrated) 96 μ, width of 1st ring 76 μ, of 2nd 71, of 3rd 56 μ.

The difference from *P. arctica* Brandt (L. 16, p. 60, pl. 3, f. 17) is only slight. My form is smaller and is rather different in appearance at the hinder part. The mouth is also quite different and the teeth much smaller. On the other hand, there is a remarkable agreement in the very prominent foremost ring and its distance from the second.

I dare not, at present, declare my form to be identical with Brandt's, with which I am as yet too imperfectly acquainted.

Very rare, only found sparsely in 6 samples: Lyngen I, 0—115 m., Lyngen II, 0—250 m., Lyngen III, 0—50 m., $^{27}/_{1}$ 1899; Malangen, $^{29}/_{1}$ 1899, 0—300 m.; Tranødybet, $^{6}/_{2}$ 1899, 0—200 m.; the Midvær Fiord $^{5}/_{4}$ 1900, 0—25 m.

Distribution: The very closely allied *P. arctica* has been found in Davis' Strait, the Labrador Current, near East Greenland and in the sea west of Nowaja Zemlja (Cleve L. 40, p. 118). Undoubtedly an arctic species, hardly native with us.

Cyttarocyclis Fol.

C. norvegica (Dad.) Jørg.

Cfr. Jørgensen L. 90, p. 28.

Only once found: Høla, Svolvær, $^{5}/_{5}$ 1899, rather numerous. Slips easily through the net.

Distribution: Rather rare, always in small numbers, on the west coast of Norway. This form and those closely allied to it, *C. gracilis* (Brandt) and *C. minuta* (Brandt), are known from West and East Greenland, the Labrador Current, Jan Mayen, Iceland, Baren Island and Spitzbergen. Arctic (and boreal?) species. Its distribution is probably insufficiently known, as it is so small that it only occasionally is retained by the net.

C. serrata (Møb.) Brandt.

Only once found: Tranødybet, $^{22}/_{3}$ 1900, 0—600 m., rr.

Distribution: Frequent on the west coast of Norway, in the summer and autumn. Also found in the summer on the north coasts of Norway (Tromsø, Aurivillius). According to Cleve (L. 40, p. 113) a southern neritic form, distributed from the Cape of Good Hope to Scotland.

C. denticulata (Ehrb.) Fol.

Cfr. Jørgensen L. 90, p. 31 and L. 92, p. 4 etc.

Many forms occurred, the most important of which are entered in the tables. As a whole, the species was very frequent, often numerous; only, at the period of the diatom inflow, very scarce or entirely absent in the outer districts.

Distribution: The majority of the numerous forms which belong here seem to be oceanic, arctic and boreal. The species is widely distributed over the northern part of the Atlantic, in the Arctic Ocean and on the arctic and northern temperate coasts. Frequent in the sea on the north coast of Scotland, August 1903 (L. 18, 1903—1904, nr. 1). According to Cleve (L. 40, p. 109) also in Behring Sea.

α typica Jørg.

Jørgensen L. 90, p. 31, pl. 2, f. 13, 15.

This form, which is the most frequent on the west coast of Norway, was not often found in the present material.

Distribution: Perhaps a neritic, northern temperate form. Most frequent in the summer and autumn on the west coast of Norway.

var. gigantea (Brandt) Cleve.

Rare and scarce.

Distribution: Possibly a boreal (and arctic?) oceanic form. Known from the northern part of the Atlantic to Greenland and Spitzbergen. Also mentioned from the Labrador Current.

var. robusta Jørg.

Jørgensen L. 92, p. 13, pl. 3, f. 22.

Only once found: Kvænangen, $^{24}/_{1}$ 1899, 0—140 m.

Distribution: Only found in the sea between Norway (Tromsø) and Jan Mayen, in small numbers. Possibly boreal. Perhaps *var. gigantea* (Brandt) p.p. also belongs here.

var. subrotundata Jørg.

Jørgensen L. 90, p. 34, pl. 2, figs. 20, 21.

Rare and scarce.

Distribution: Not so rare on the west coast of Norway in the summer (1898). Possibly a neritic, northern temperate species.

var. cylindrica Jørg.

Jørgensen L. 90, p. 33, pl. 2, figs. 17, 18.

Rather rare, never numerous.

Distribution: Not rare on the west coast of Norway in the summer and autumn. Possibly neritic, northern temperate species.

var. elongata Jørg.

Jørgensen L. 92, p. 14, pl. 3, figs. 23, 24.

Rather rare, almost always in small numbers.

Distribution: Known from the sea between Tromsø and Jan Mayen (numerous, 1898). Seems to be a boreal, oceanic form.

var. subedentata Jørg. n. var.
(Pl. XVIII, figs. 119, 120; pl. XIV, fig. 121).

The house as usual somewhat dilated a little below the mouth, and then slightly, or imperceptibly, narrowing. In the lowest $^1/_4$ rather quickly narrowing to a rather short tip. The side contour here shows a long, rather even arch. Teeth rather small, about 35—38, may also be wanting. Areoles as usual hexagonal, thin-walled, medium sized (about $2^1/_2$ on 10 μ).

This variety is reckoned together with α typica in the tables for the first half of the year 1899. Its place is between that form and *var. obtusangula* (Ostenf.) Jørg. and *C. edentata* Brandt, most near the two latter; it is, however, so different from them that it ought not to be considered right away the same as *var. obtusangula.*

The length of the tail tip as usual varies considerably. The relation between length and breadth generally lies between 2.5 and 3 (the tail tip excluded).

Fig. 119 is a smaller, more divergent form.

Numerous and frequent, as a whole, in the present material, the most frequent form of the species. Occurred also, though in small numbers, during the diatom inflow. It is more frequent than appears from the tables, as it was not entered separately from the first, but is included under „*Cyttarocylis denticulata*".

Undella *caudata* (Ostenf.) Cl.

Tintinnus caudatus Ostenfeld L. 113, p. 437 (601). *Undella pellucida* Jørg. L. 90, p. 41, pl. 1, figs. 7, 8.

Rather frequent, but always in small numbers.

Distribution: Temperate, oceanic species, according to Cleve (L. 40, p. 124) distributed far southwards in the warmer part of the Atlantic. Rare on the west coast of Norway.

Dictyocysta *templum* Hck.

The principal species, with a single row of large windows around the mouth of the house, very rare: Senjen $^{21}/_1$ 1899, 0—50 m., r.

var. disticha Jørg.

Jørgensen L. 90, p. 40.

With two rows of windows.

More frequent, in a good number of samples, but always scarce.

Distribution: Cleve's *D. elegans* Ehrb. which also includes the two forms mentioned, is widely distributed from the warmer part of the Atlantic to beyond Iceland (Cleve L. 40, p. 114). According to Cleve, also known from the Mediterranean, the Red Sea and the Indian Ocean. Rare on the west coast of Norway.

Errata et Addenda.

Pag. 96, col. 2, line 28, for ***T. decipiens*** Grun. read:
T. decipiens (Grun.).

Pag. 105, col. 1, after line 2 add
(Plate VII, fig. 26).

Pag. 108, col. 1, before **II. Peridiniales** add:

Tropidoneis *parallela* Jørg. n. sp.
(Plate VII, fig. 16).

In the plankton tables *Amphiprora parallela* n. sp.

Shape of the cell in side view: Linear, or slightly oblong, not constricted in the middle, narrowing off a little towards the rounded ends. Central nodule rather indistinct; terminal nodules, however, very conspicuous.

Valve: Linear-lanceolate, ends subrostrate (truncate). Median line straight, central. Central nodule small, terminal nodules close to the ends.

The median part of the valve seems to form a rather high, linear keel, about so broad as $^1/_3$ of the valve.

Structure: Fine transverse striæ, not distinctly punctate, 17 on 10 μ.

Dimensions: Length of the valve 67—70 μ, breadth 12 μ. Breadth of the cell (frustule) 18 μ.

This species resembles *Amphoropsis recta* Grun. (Van Heurck L. 89, p. 266, fig. 55) and *Amphiprora plicata* var.? *subplicata* Grun. (L. 48, p. 65, pl. V, fig. 88). It differs from both in having the frustules quite inconstricted in the middle. On the contrary, the cell is often somewhat broader (higher) here. Besides, I have never seen an asymmetrical valve, like that characteristic of *Amphoropsis recta*. I have, however, only once succeeded in getting a valvar view of it (fig. 16 b), as in the preparations it is nearly always found lying on its side.

Cleve refers (L. 24, p. 28) *Amphiprora plicata* var.? *subplicata* Grun. as a variety to *Amphoropsis recta (Tropidoneis recta* Cl.) without mentioning the shape of the valve.

The above species seems to be a true plankton form. It has very thin (slightly siliceous) valves which easily are deformed on being ignited on the cover-glass. It generally occurs solitary or by twos, very seldom forming a short chain of some few individuals.

On the whole rare and sparse, only observed during the diatom inflow in 1900: Høla, Svolvær, $^{20}/_3$, 0—140 m.; Østnesfjord I and III, $^{23}/_3$, 0—25 and 0—130 m.; the Vestfjord, $^{30}/_3$, 0—25 m.; the Skjerstadfjord IV, $^2/_4$, 0—330 m., and XII, 0—500 m.; the Seivaagen, $^5/_4$, 0—20 m.; the Saltenfjord II, $^5/_4$, 0—50 m.; the Foldenfjord I, $^6/_4$, 0—100 m. Also in Barent's Sea, 71° 48′ n., 49° 38′ e., S/S Heimdal $^{31}/_5$ 1900.

Undoubtedly an arctic species.

Page 100, add:

C. scolopendra Cl.

As endocysts, resembling those of *C. cinctus,* are found, the older name for the latter species, *C. incurvus* Bail., cannot be used.

Very rare and sparse: Sea off Ingø, $^{24}/_4$ 1899, 0—300 m.; the Porsangerfjord, $^{27}/_4$ 1899, 0—75 m.

Distribution: More frequent on the west coast of Norway. According to Cleve a northern (boreal) neritic species. Only once (in October 1900) found near the Færø Isles. (Ostenfeld).

Page 105, after ***Naviculeæ*** add:

Pinnularia quadratarea (A. Schm.) Cl.

Cl. L. 25. p. 95. *Navicula quadratarea* A. Schm. L. 127, p. 90, pl. II, f. 26. *N. pinnularia* Cl. L. 28, p. 224, pl. IV, fs. 1—2.

Occurs only accidentally. No true planktonform, but rather frequent in bottom samples from both the west and the north coast of Norway.

Page 99, before *R. styliformis,* add:

R. obtusa Hens.

Hensen L. 87, p. 86, pl. V, f. 41. *R. alata var. truncata* Gran L. 64, p. 6, pl. IV, f. 67.

Not always easy to distinguish from *R. alata* (cfr. Ostenfeld L. 116, p. 569).

Very rare and sparse, only in 3 samples: Stene in Bø, $^{10}/_4$ 1899, 0 m.; the Porsangerfjord, $^{27}/_4$ 1899, 0—75 m. and 200—100 m.

Distribution: According to Cleve, Gran and Ostenfeld a boreal oceanic species, occasionally numerous round the Færøes, Iceland and in the Norwegian Ocean, up to the north of Spitzbergen. Is wanting on the west coast of Norway (1898). In large numbers in arctic water between Tromsø and Jan Mayen 1897, also numerous round Jan Mayen 1897—1898, and near Spitzbergen 1899—1900 (Jørgensen L. 92). Seems to me to be an arctic (oceanic) rather than a boreal species.

Page 104, col. 1, line 10, for Pl. VI read Pl. VII.

Page 105, col. 1, line 2, add: (Plate VII, fig. 26).

Page 109, col. 1, line 36, for (Dies.) Clap. et Lachm. read (Clap. et Lachm.) Dies.

Pag. 119, col. 1, line 49, for 80 read 86.

For Midværfjord everywhere read Misværfjord.

Bibliography.

1. L. 91, pp. 4—5.
2. L. 112, p. 65.
3. L. 70, pp. 112—116.
4. AURIVILLIUS, C. W. S., Das Plankton der Baffins Bay und Davis' Strait. Upsala 1896. Festskrift för Lilljeborg, p. 181.
5. The same, Vergleichende thiergeographische Untersuchungen über die Plankton-Fauna des Skageraks. Kongl. Sv. Vetensk. Akad. Handl., vol. 30, no. 3. Stockholm 1898.
8. BAILEY, I. W., New Species of Diatomaceæ. Quart. Journ. of Microsc. Sc., vol. 3. London 1855.
9. The same, On Microscopic Forms in the Sea of Kamtschatka. Americ. Journ. of Sc. and Arts, (second series) vol. 22, 1856.
12. BORGERT, A., Vorbericht über einige Phaeodarien-Familien der Plankton-Expedition. Reisebeschreibung der Plankton-Expedition, p. 184. Kiel und Leipzig 1892.
13. The same, Die tripyleen Radiolarien des Mittelmeeres. Mittheilungen aus der Zoologischen Station zu Neapel, vol. 14, 1901.
14. The same, Die nordischen Tripyleen-Arten. Nordisches Plankton, hrsg. von Prof. Dr. K. BRANDT, XV. Kiel und Leipzig, 1901.
16. BRANDT, K., Die Tintinnen. Zoologische Ergebnisse der von der Gesellschaft für Erdkunde zu Berlin unter Leitung Dr. VON DRYGALSKI's ausgesandten Grønlandsexpedition nach Dr. VANHÖFFENS Sammlungen bearbeitet. Bibliotheca Zoologica, Heft 20, Lfg. 2. 1896.
18. Bulletin des résultats acquis pendant les courses périodiques publié par le bureau du conseil avec l'assistance de M. KNUDSEN. Conseil permanent international pour l'exploration de la mer. Année 1902—1903, nos. 1—4; 1903—1904, no. 1.
19. BÜTSCHLI, O., Protozoa, Abtheil. I—III. Dr. H. G. BRONN's Klassen und Ordnungen des Thierreichs, Bd. I.
22. CLEVE, P. T., On Diatoms from the Arctic Sea. Bih. till Kongl. Sv. Vetensk. Ak. Handl., vol. 1, no. 13. Stockholm 1873.
24—25. The same, Synopsis of the naviculoid diatoms. Kongl. Sv. Vetensk. Ak. Handl., I vol. 25, II vol. 27. Stockholm 1893—96.
26. The same, Diatoms from Baffins Bay and Davis Strait. Bih. till Kongl. Sv. Vetensk. Ak. Handl., vol. 22, III, no. 4.
27. The same, A Treatise on the Phytoplankton of the Atlantic and its Tributaries and on the Periodical Changes of the Plankton of Skagerak. Upsala 1897.
28. The same, Svenska och Norska Diatoméer. Öfvers. af Kongl. Sv. Vet. Ak. Förh. Stockholm 1868.
30. The same, Plankton collected by the Swedish Expedition to Spitzbergen in 1898. Kongl. Sv. Vetensk. Ak. Handl., vol. 32, no. 3. 1899.
36. The same, Notes on some Atlantic Plankton-Organisms. Kongl. Sv. Vetensk. Ak. Handl., vol. 34, no. 1. Stockholm 1900.
40. The same, The seasonal distribution of Atlantic plankton organisms. Gøteborg 1901.
45. The same, Diatoms, collected during the Expedition of the Vega. Vega-Expeditionens vetenskapliga iagttagelser, vol. III. Stockholm 1883.
46. The same, Report on the Phyto-Plankton collected on the Expedition of H. M. S. „Research", 1896. 15th annual Report of the Fishery Board of Scotland, part III, no. X.
48. CLEVE, P. T. and GRUNOW, A., Beiträge zur Kenntniss der arktischen Diatomeen. Kongl. Sv. Vetensk. Ak. Handl., vol. 17, no. 2. Stockholm 1880.
50. DE TONI, I. B., Sylloge Algarum. 1894.
53. EHRENBERG, C. G., in Monatsber. d. k. preuss. Ak. d. Wiss. zu Berlin, 1861 (p. 301).
54. The same, in Monatsber. d. k. preuss. Ak. d. Wiss. zu Berlin, 1843 (p. 270).
63. GOURRET, P., Sur les Peridiniens du Golfe de Marseille. Annal. du Musée d'hist. natur. de Marseille, Zool., vol. I, no. 8. Marseille 1883.
64. GRAN, H. H., Diatomaceæ, Silicoflagellata og Cilioflagellata. Den norske Nordhavsexpedition 1876—78. Botanik. Kristiania 1897.
65. The same, Bacillariaceen aus dem kleinen Karajakfjord. Bibliotheca botanica, heft 42.
67. The same, Hydrographic-biological Studies of the North Atlantic Ocean and the Coast of Nordland. Report on Norwegian Fishery- and Marine-Investigations, vol. I, 1900, no. 5.
68. The same, Bemerkungen über einige Planktondiatomeen. Nyt Magazin for Naturvidenskaberne, vol. 38, h. 2. Kristiania 1900.
69. The same, Ueber die Verbreitung einiger wichtiger Planktonformen im Nordmeere. Petermanns Mittheilungen, Bd. 47, p. 79.
70. The same, Das Plankton des Norwegischen Nordmeeres von biologischen und hydrographischen Gesichtspunkten behandelt. Report on Norwegian Fishery- and Marine-Investigations, vol. II, 1902, no. 5. Bergen 1902.
73. GREENLEAF, R. C., On a new species of Nitzschia. Proceed. of Boston Soc. Nat. Hist. 1865, p. 107. Boston 1865.

74. Gregory, W. M. D., On new forms of marine Diatomaceæ found in the Firth of Clyde and in Loch Fyne. Transact. of the Royal Soc. of Edinburgh, vol. 21. Edinburgh 1857.

75. The same, On the Post-Tertiary Diatomaceous Sand of Glenshira, part II. Transact. of the Microsc. Soc. of London, vol. V, n. s., p. 67. London 1857.

83. Grunow, A., Die Diatomeen von Franz Josefs Land. Denkschriften d. math.-naturw. Classe d. kaiserlich. Akad. d. Wissensch. Wien 1884.

84. Haeckel, E., Die Radiolarien. Berlin 1862.

86. The same, Report on the Radiolaria collected by H. M. S. Challenger. Report on the scientific results of the exploring voyage of H. M. S. Challenger during the years 1873—76, vol. 18.

87. Hensen, V., Ueber die Bestimmung des Planktons. 5ter Bericht d. Kommission zur wissensch. Untersuchung d. deutschen Meere. Berlin 1887.

88. Heurck, H. van, Synopsis des Diatomées de Belgique. Anvers 1885.

89. The same, Traité des Diatomées. Anvers 1899.

90. Jørgensen, E., Ueber die Tintinnodeen der norwegischen Westküste. Bergens Museums Aarbog 1899, no. II.

91. The same, Protophyten und Protozoën im Plankton aus der norwegischen Westküste. Bergens Museums Aarbog 1899, no. VI.

92. The same, Protistenplankton aus dem Nordmeere in den Jahren 1897—1900. Bergens Museums Aarbog 1900, no. VI.

106. Murray, J., Report on the scientific results of the exploring voyage of H. M. S. Challenger 1873—76, vol. I: Narrative of the cruize, first part. London 1885.

110. Nordquist, O., Bidrag till kännedomen om Bottniska Vikens och Norra Östersjöns evertebratfauna. Meddel. af Societ. p. Fauna et Flora Fennica, 17. Helsingfors 1890.

111. Ostenfeld, C., Iagttagelser over Overfladevandets Temperatur, Saltholdighed og Plankton paa islandske og grønlandske Skibsrouter i 1898, bearbeidede af Martin Knudsen og C. Ostenfeld. Kjøbenhavn 1899.

112. The same, Iagttagelser over Overfladevandets Temperatur, Saltholdighed og Plankton paa islandske og grønlandske Skibsrouter i 1899, bearbeidede af Martin Knudsen og C. Ostenfeld. Kjøbenhavn 1900.

114. The same, Iagttagelser over Plankton-Diatomeer. Nyt Magazin for Naturvidenskaberne, vol. 39. Kristiania 1901.

116. The same, Phytoplankton from the sea around the Færøes. 1900. Botany of the Færøes, II. Copenhagen 1903.

117. The same and Schmidt, Johs., Plankton fra det Røde Hav og Adenbugten (Plankton from the Red Sea and the Gulf of Aden). Videnskabelige Meddelelser fra den naturhist. Forening i Kjøbenhavn, 1901.

118. Peragallo, H., Monographie du genre Pleurosigma. Le Diatomiste 1890—91.

119. Pettersson, O. and Ekman, G., Die hydrographischen Verhältnisse der oberen Wasserschichten des nördlichen Nordmeeres zwischen Spitzbergen, Grønland und der norwegischen Küste in den Jahren 1896 u. 1897. Bih. till Kongl. Sv. Vetensk. Ak. Handl., vol. 23, II, no. 4. Stockholm 1898.

123. Pritchard, A., A History of Infusoria. London 1861.

124. Rattray, John, A revision of the genus Coscinodiscus Ehrb. and of some allied genera. Proceed. Royal Soc. of Edinburgh, vol. XVI, p. 449. Edinburgh 1890.

125. The same, A revision of the genus Actinocyclus Ehrb. Journ. of Queck. Microsc. Club. London 1890.

126. Roper, F. C. S., Notes on some New Species and Varieties of British Marine Diatomaceæ. Quart. Journ. of Micr. Sc., vol. 6, p. 21.

127. Schmidt, A., Die in den Grundproben der Nordseefahrt 1872 enthaltenen Diatomaceen. Jahresbericht d. Commiss. z. wissensch. Untersuchung d. deutschen Meere in Kiel für die Jahre 1872—73, IV.

128. The same, Atlas der Diatomaceenkunde. Aschersleben 1874—1904.

129. Schrøder, Bruno, Das Phytoplankton des Golfes von Neapel nebst vergleichenden Ausblicken auf das des atlantischen Oceans. Mittheilungen aus der zoologischen Station zu Neapel, vol. 14. Berlin 1900.

130. Schütt, F., Das Pflanzenleben der Hochsee. Ergebnisse d. Plankton-Expedition d. Humboldt-Stiftung, vol. I, A. Kiel and Leipzig 1892.

134. Smith, W., Synopsis of the British Diatomaceæ. London 1853—56.

135. Stein, F. von, Der Organismus der Infusionsthiere, IIIte Abtheilung. Leipzig 1878—83.

137. Wallich, G. C., On the siliceous organisms found in the digestive cavities of the Salpæ. Transact. of the Microscop. Soc. of London, vol. VIII, n. s., p. 36. London 1860.

138. Østrup, E., Marine Diatoméer fra Østgrønland. Meddelelser om Grønland, Hefte 18, p. 395. Kjøbenhavn 1896.

139. The same, Kyst-Diatoméer fra Grønland. Meddelelser om Grønland, hefte 15, p. 305. Kjøbenhavn 1898.

Index
(not including the tables).

III. BOTTOM-LIFE.

NOTES.

When dredgings have been made, soundings, both at the start and finish of the haul, have generally been taken. So that when, for instance, Øxsund 450—630 m. is noted, it is to be understood that the depth was 630 m. where the dredge was thrown out, and 450 m. where the dredging was ended.

A. Results of Dredgings.

a. Dredging stations. 1899—1900.

Nr.	Date	Name	Dept in metres	Temperature of the bottom layer C°	Salinity of the bottom layer ‰	Nature of the bottom	Remarks
	1899						
1	13/2	Henningsværstrømmen	20—40	1.75	33.42	Stones and *Lithothammion*	Between Øst- and Vestvaagø.
2	14/2	Liland, Østnesfjord	30—40			Clay	Østvaagø, Lofoten.
3	—	Langstrand	50—70			Pebbles	Østvaagø, Lofoten.
4	15/2	Skroven—Guldbrandsøerne..				Clay	Østlofoten.
5	16/2	Brettesnes—Skroven	350—410	6.3	35.08	Clay	Østlofoten.
6	—	Mouth of Raftsund	250—300			Clay	Between Hindø and Østvaagø.
7	—	At Digermulen	100—150			Stones and sand	In Raftsund.
8	17/2	Øxsund	450—680	6.3	35.08	Clay	Between Hammerø and Lundø.
9	18/2	Sagfjord..................	200	6.4	34.80	Clay	At the inner end of Furunesvæggen.
10	22/2	Mortsund I	230	6.6	35.03	Clay	SE of Mortsund.
11	—	Mortsund II				Clay	SE of Mortsund.
12	—	Mortsund III...............	100—120			Sand and stones	SE of Mortsund.
13	1/3	Moskenstrømmen I	204	6.6	34.97	Sand and clay	Between Værø and Moskenesø.
14	—	Moskenstrømmen II........	150	5.0	34.40	Shells and stones	Between Værø and Moskenesø.
15	3/3	Kirkfjord I	108—130	2.7	33.48	Clay	At little inside the Vorfjord.
16	—	Kirkfjord II	50	2.5	33.40	Clay?	In the middle of the Kirkfjord.
17	—	Kirkfjord III..............	70—80			Clay and stones	At Tennes.
18	—	Kirkfjord IV..............	30—50			Shells and clay	In the Vorfjord.
19	4/3	Reine I	150	6.7	34.70	Sand	11 miles SE of Reine.
20	6/3	Ure I	230	6.8	34.97	Clay	9½ miles SSE of Ure.
21	—	Henningsvær I	140	6.2	34.52	Rocky	6 miles SW b W ½ W of Henningsvær.
22	10/3	Risværflaket	150—180	1.6	33.40	Clay	Outside the Øgsfjord, off the Pundsletvaag.
23	14/3	Øgsfjord I................	100	2.1	33.10	Clay	At the head of the fiord.
24	16/3	Tranødybet	450—530	6.3	35.06	*Lophohelia*	Between Tranø and Lødingen.
25	—	Tranødybet	607—640	6.3	35.06	Clay	Between Tranø and Lødingen.
26	17/3	Kanstadfjord, inside the ridge	30—90	1.6	33.48	Sand, clay and stones	At Hindø.
27	—	Kanstadfjord,outside the ridge	95	4.4	34.06	Rocky	At Hindø.
28	22/3	Røsthavet................	350—500	4.05	35.13	?	68° 3′ N., 10° 0.5′ E.
29	24/3	Røst I	120	4.25	34.60	Fragments of shells	Outside Røst.
30	—	Røst II	100	4.85	34.79	Pebbles and fragm. of shells	Outside Røst.
31	25/3	Røst II..................	150	6.7	35.11	Fragments of shells	Inside Røst.
32	28/3	Tysfjord I................	500	6.3	35.11	*Lophohelia*	Inside Skarberget.
33	7/4	Stene	120—200	6.6	34.99	Rocky	Vestlofoten.
34	—	Reine	100	4.5	34.42	Rocky	Vestlofoten.
35	—	Moskenstrømmen	90	4.1	34.29	Stones	Between Moskenesø and Værø.
36	11/4	Gaukværø	250	5.2	34.86	Clay	68° 34′ N., 14° 17′ E.
37	14/4	Malangenfjord.............	380	4.1	34.67	Clay	Off Stønnesbotn.
38	—	Malangen II	100—200			Clay, Rocky	Between Stønneshotn and Lysbotn.
39	—	Malangen III	200	3.7	34.54	Clay, Rocky	Between Stønneshotn and Lysbotn.
40	15/4	Stønnesbotn	40—80			Rocky	At Senjen Island.
41	19/4	Kvænangen II	90	0.75	34.21	Clay, Stones	At Nøklen island.
42	20/4	Jøkelfjord I	110	1.0	34.29	Clay	At the head of the fjord.
43	—	Jøkelfjord II..............	80			Clay	At the head of the fjord.
44	21/4	Jøkelfjord III	110	1.4	34.35	Rocky	Off Tverfjord.
45	—	Kvænangen	300—343	2.3	34.49	Clay	Between Spildern and the northern mainland.
46	24/4	Ingøhavet	270—315	3.45	35.24	Rocky	71° 10′ N., 23° 10′ E.
47	25/4	Troldfjordsund	30—40			Sand	Between Ingø and Rolfsø.
48	—	Breisund..................	100	1.7	34.54	Sand, Rocky	Between Havø and Hjelmesø.
49	26/4	Repvaag harbour	10			Sand	In Porsangerfjord.
50	27/4	Porsangerfjord	200	0.2	34.48	Clay, Rocky?	Between Great and Little Tamsø.
51	—	Porsangerfjord	70			Rocky	Between Great and Little Tamsø.
52	—	Porsangerfjord	30—50			Pebbles, *Lithothammia*	Between Great and Little Tamsø.
53	8/5	Lyngenfjord II	250	2.85	34.97	Clay	Off the Kaafjord.
54	—	Lyngen III	320	3.65	34.84	Clay	Between ytre Gamvik and Ulø.
	1900						
55	23/3	Østnesfjord I	20—30			Stones and *Lithothammia*	At the head of the fjord.
56	—	Østnesfjord II.............					Betveen Vaterfjord and Følstad.
57	—	Østnesfjord III............					Off Helle.
58	26/3	Balstad..................	150—180				Vestlofoten.
59	30/3	Landego	400	6.2	35.13	Clay	67° 22′ N., 14° 4′ E.
60	—	Arnø	300—400	6.55	35.18	Rocky	67° 11 N., 14° 2′ E.
61	—	Sund harbour	0			Sand	In Gildeskaal.
62	31/3	Morsdalfjord (S. Beierfjord)	50—150			Clay	Between Sandhornø and Sund.

Nr.	Date	Name	Depth metres	Temperature of the bottom layer C°	Salinity of the bottom layer ‰	Nature of the bottom	Remarks
	1900						
63	31/3	N. Beiersfjord	50			Fragments of shells	Between Sandhornø and Beieren.
64	2/4	Skjerstadfjord I	30—50			Sand, Clay	The head of Skjerstadfjord.
65	—	Skjerstadfjord II	100—185	3.35	33.99	Clay	1½ miles from the end.
66	—	Skjerstadfjord III	230	3.2	33.99	Rocky	
67	—	Skjerstadfjord IV	330	3.15	34.04	Clay	
68	3/4	Skjerstadfjord VI	100—150			Clay	At Fauske.
69	—	Skjerstadfjord VII	470—490	3.15	33.99	Clay	Off Fauske.
70	—	Skjerstadfjord VIII	490			Clay	
71	—	Skjerstadfjord IX	30—50			Rocky	
72	—	Skjerstadfjord X	10—30			*Lithothamnion*	Mouth of the Misværfjord.
73	—	Skjerstadfjord XI	50			Shells	Misværfjord.
74	4/4	Skjerstadfjord XVI	10—20			Sand	Inside Saltstrømmen.
75	5/4	Saltenfjord I	15—20			Sand, Clay	Seivaagen.
76	—	Saltenfjord II	320—370	6.65	35.13	Clay	Inside the mouth.
77	6/4	Foldenfjord I	530	6.55	35.00	Clay	Between Hjertø and the southern mainland.
78	7/4	Grøtø	6—24			Sand	

In the list of animals collected, I have also included some which I caught during a short trip to Finmark in the months of August and September 1894. I have added the year (1894), after the name of place, for all such.

b. Outcome of Dredgings.

Porifera.[1])

W. Lundbeck, Mag. scient., Copenhagen, determ.

Asbestopluma pennatula, O. Schmidt.

The Lyngen Fiord, 300 m.

Cladorhiza abysssicola, M. Sars.

The Salten Fiord, Skroven (Vest Fiord), 400 m.

Bubaris vermiculata, Bowerbank.

Reine (the Vest Fiord), 150 m.

Stylocordyle borealis, Lovén.

The Skjerstad Fiord, 230 m.

Tentorium semisuberites, O. Schmidt.

The Skjerstad Fiord, 230 m.

Halicnemia verticillata, Bowerbank.

Moskenstrømmen, 200 m.

Trichostemma hemisphæricum, M. Sars.

The Lyngen Fiord, 250 m.

Tethya lyncurium, Johnst.

The Porsanger Fiord, 200 m.

Craniella cranium, Müll.

The Sag Fiord, 200 m.

1) Not many sponges were found, but those which were obtained were classified at once by Mag. Lundbeck, together with material belonging to the Danish Ingolfexpedtion. Only a few species are noted here, the names of which Mr. Lundbeck has kindly furnished me with.

Hydrozoa.

Hydroida.

Miss Bonnevie, Kristiania, determ. Remarks by the author.

Corymorpha sarsi, Steenstrup.

Mehavn (1894).

Tubularia indivisa, Lin.

Svolvær (1894); Balstad (1896); Breisund, 100 m.; the Porsanger Fiord, 200 m.

Tubularia larynx, Ell. & Sol.

Nordkyn (1894).

Tubularia variabilis, Bonn.

The Porsanger Fiord, 200 m. This species has previously been found at Rauberget in the Trondhjem Fiord, and by the Norwegian North Atlantic Expedition at stations 325 and 362.

Tubularia humilis, Allman.

Svolvær (1894); Nordkyn (1894).

Perigonimus repens, Wright.

Balstad (1996). Has been observed from Bergen to Lofoten.

Dicoryne conferta, Alder.

Svolvær (1894).

Hydrachtinia echinata, Flemming.

Svolvær (1894); Balstad (1896).

Eudendrium rameum, Pall.

The Østnes Fiord.

Eudendrium insigne, HINCKS.

Moskenstrømmen. Only collected on the Norwegian coast in Moskenstrømmen.

Eudendrium tenellum, ALLMAN.

Moskenstrømmen.

Halecium halecinum, LIN.

Napstrømmen (1896); the North Cape (1894).

Halecium labrosum, ALDER.

Moskenstrømmen; the North Cape (1894).

Halecium tortile, BONN.

Balstad (1897). Up to the present, only known from Balstad (Lofoten).

Halecium scutum, CLARK.

The North Cape (1894); Nordkyn (1894).

Halecium sessile, NORMAN.

The North Cape (1894).

Halecium schneideri, BONN.

Nordkyn (1894).

Lafoëa serpens, HASSAL.

The Ingø Sea, 300 m.; Nordkyn (1894).

Lafoëa abietina, M. SARS.

Moskenstrømmen; Balstad (1897); The Ingø Sea, 300 m.; The North Cape (1894).

Lafoëa gracillima, ALDER.

Balstad (1897); The Ingø Sea, 300 m.; Malangen 100—200 m.

Lafoëa dumosa, FLEMMING.

Hammerfest (1894).

Lafoëa fruticosa, M. SARS.

Moskenstrømmen; Balstad (1897); Malangen, 100—200 m.; Hammerfest (1894); Sværholt (1894); The Porsanger Fiord, 200 m.

Lafoëa symmetrica, BONN.

The Ingø Sea, 300 m. This species has been found, in addition to the place here mentioned, at station 313 (The Norw. North. Atl. Exp.).

Campanularia verticulata, LIN.

Malangen, 100—200 m.; Hammerfest (1894); The North Cape (1894); The Porsanger Fiord; Nordkyn.

Campanularia geniculata, MÜLL.

Svolvær (1894); The North Cape (1894); Nordkyn (1894).

Campanularia dichotoma, LIN.

The North Cape (1894).

Campanularia hyalina, HINCKS

Balstad (1897); The Porsanger Fiord, 200 m. Up to this time, the most northerly known limit was The Trondhjem Fiord.

Campanularia johnstoni, ALDER.

Balstad (1897); Hammerfest (1894); Mehavn (1894).

Campanularia hincksi, ALDER.

Balstad (1897).

Campanularia calyculata, HINCKS.

The North Cape (1894); Nordkyn (1894).

Campanularia volubilis, LIN.

Moskenstrømmen; Balstad (1897).

Campanularia syringa, LIN.

Balstad (1897).

Sertularella polyzonias, LIN.

Hammerfest (1894); Breisund, 100 m.; The North Cape (1894); Nordkyn (1894).

Sertularella tricuspidata, ALDER.

Moskenstrømmen; Hammerfest (1894); Ingøhavet, 300 m.; Breisund; The North Cape (1894).

Dynamena pumila, LIN.

Malangen.

Dynamena tamarisca, LIN.

Moskenstrømmen; Svolvær (1894); Hammerfest (1894).

Thuiaria abietina, LIN.

Moskenstrømmen; Hammerfest (1894); Nordkyn (1894).

Thuiaria argentea, ELL. & SOL.

The North Cape (1894).

Thuiaria filicula, ELL. & SOL.

Balstad (1897); Breisund, 100 m.; The North Cape (1894); Nordkyn (1894); Mehavn (1894).

Thuiaria articulata, PALL.

Malangen, 100—200 m.

Thuiaria thuja, LIN.

Svolvær (1894); Breisund, 100 m.; The North Cape (1894).

Hydrallmania falcata, LIN.

Svolvær (1894); The Kanstad Fiord, 20—90 m.

Aglaophenia integra, G. O. SARS.

Ingøhavet, 300 m.

Aglaophenia pourtalesi, VERRILL.

Ingøhavet, 300 m. The previously known distribution extended from Espevær to the Trondhjem Fiord.

Antennularia antennina, LIN.

Hammerfest (1894); Breisund.

Papers about hydroids: KRISTINE BONNEVIE, Hydroida. The Norw. North Atl. Exp.

On p. 98 *et seq.* of this work will be found a complete list of papers.

Scyphozoa.

Lucernaria quadricornis, Müll.

Hammerfest (1894); Mehavn (1894); The Skjerstad Fiord.

M. Sars has given a detailed description of this animal.[1]) He notes the following places where it has been found: Glesvær, Solsvik, Florø, Kinn, all of these being on the Bergen coast. My locality in the Skjerstad Fiord (S. XVI) lies just inside Saltstrømmen. Here several specimens of *Lucernaria* were found on algae at a depth of from 10—20 m.

Anthozoa.

Alcyonaria.

James A. Grieg determ. Remarks by tke author.

Alcyonium digitatum, Lin.

The Skjerstad Fiord (S. X), 10—30 m. The locality in the Skjerstad Fiord is the northern limit for this species as far as is now known. Its distribution, according to Dr. Walter May, is confined to Norway and England.[2])

Paraspongodes fruticosa, M. Sars.

The Skjerstad Fiord (S. III), 230 m.; the sea NW of Røst, 700 m.; The Porsanger Fiord, 200 m.

The species is common in the Arctic Sea.

Paraspongodes rosea, Dan. & Kor.

Balstad, 80 m.

Paramuricea placomus, Lin.

Arnø, 300—400 m.

The species has not, up the present, been found north of this place. In „Beretning om en zoologisk Reise (1849)“ M. Sars mentions the following animals belonging to this group: *Primnoa lepadifera,* Lin., from the Øx Fiord and Hammerfest, and *Paragorgia arborea,* Lin. from the Øx Fiord. The last mentioned species has been taken at two stations (183—260 m.), in the Murman Sea by the Austro-Hungarian Expedition.[3])

Isidella hippuris, Gunnerus.

The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Øxsund, 600 m.; Brettesnes-Skroven, 350—400 m.

Storm has caught this species in the Trondhjem Fiord, according to Grieg[4]), and Gunnerus mentions it from Smølen. Under the name of *Mopsea borealis* it is fully described by G. O. Sars[5]) from specimens caugth at the fishing station Skroven in Lofoten.

Pennatula aculeata, Dan. & Kor.

At Risvær (Lofoten), 150—180 m.

Kophobelemnon stelliferum, O. F. Müll.

The Salten Fiord, 320—380 m., Landego, 400 m.

[1]) Cfr. *Fauna littoralis Norvegiæ,* Part 1, pag. 20.

[2]) Cf. Walter May, Beiträge zur Systematik und Chorologie der Alcyonaceen, p. 104. Abdruck aus der jenaischen Zeitschrift f. Naturw. Vol. XXXIII. N. F. XXVI.

[3]) Cf. Stuxberg. Faunaen på och kring Novaja Semlja, p. 163.

[4]) Bidrag til kjendskaben om de nordiske alcyonarier, p. 5. Berg. Mus. Aarb. 1893.

[5]) On Some Remarkable Forms of Animal Life, I, p. 50, pl. V, figs. 1—23.

According to Grieg[1]), this species was known from the Kristiania Fiord to the Trondhjem Fiord. Its northern limit is now the Vest Fiord.

Cladiscus gracilis, Dan. & Kor.

The Skjerstad Fiord, 230 m.

Grieg mentions that the type-specimen was from Slotholmen in Nordland (l. c. p. 18). The species has also been caught in the Trondhjem Fiord by V. Storm.

Zoantharia.

James A. Grieg determ. Remarks by the author.

Ulocyathus arcticus, M. Sars.

The Salten Fiord, 320 m.; Landego, 400 m.; The Folden Fiord, 530 m.; Øxsund, 600 m.; The Sag Fiord, 200 m.; Mortsund, 200 m.; Ure, 250 m.; Reine, 150 m.; The Lyngen Fiord, 300 m.

During his expedition in the summer of 1849, Michael Sars found this peculiar species in the Øx Fiord, and in the account a short description was given of it. Later on, it was thoroughly described.[2]) A contribution respecting its anatomy has been made by Miss Emily Arnesen.[3]) The Austro-Hungarian expedition collected this species at two stations in the Murman Sea. (183 m., 230 m.).

Lophohelia prolifera, Pall.

Tranødybet, 450—530 m.; The Tys Fiord (T. I), 500 m.

This species was seen in large quantities especially at the place last mentioned. The *Lophohelia*-reef at the mouth of the Tys Fiord is, as far as I know, the most northerly which has hitherto been observed. Later on in this treatice, I will refer somewhat more in detail to this interesting formation.

Actiniaria.

Dr. Carlgren, Stockholm, determ. Remarks by the author.

Protanthea simplex, Carlgr.

The Tys Fiord (T. I) 500 m. On *Lophohelia prolifera,* Pall.

Carlgren says, in a written communication to me, that *Protanthea* is only found in Bohuslen and on the Norwegian coast. The distribution of this species hitherto known is Bohuslen—Lofoten.

Edwardsia andresi, Dan.

The Lyngen Fiord (L. III), 300 m.; The Skjerstad Fiord, 320 m.

It was caught by the Norw. North Atl. Exp. at St. 253 (The Skjerstad Fiord, 481 m.).[4])

Paraedwardsia arenarea, Carlgr., nov. gen. nov. sp.

The Skjerstad Fiord, 320 m.

The new genus and species will later on be thoroughly described by Dr. Carlgren. In a written communication to me he says:—„*Paraedwardsia* is characterized by 8 complete mesenteries like *Edwardsia,* but the scapus in *Paraedwardsia* is furnished with

[1]) Oversigt over Norges pennatulider, p. 16. Berg. Mus. Aarb. 1891.

[2]) *Fauna littoralis Norvegiæ.* Part II, p. 73, pl. 10, figs. 18—27.

[3]) Beiträge zur Anatomie und Histologie von *Ulocyathus arcticus* etc. Archiv f. Math. og Naturv. Vol. XX. Nr. 9.

[4]) Cfr. Danielssen, Actinida, p. 111.

papilla like *Halcampa*, and foreign bodies (grains of sand) are fastened to these papillæ.

Bolocera tuediae, Johnst.

The Malangen Fiord, 380 m.; Stønnesbotn, 40—80 m.

Tealia (Madoniactis) lofotensis, Dan.

Stønnesbotn, 40—80 m.; The Øgs Fiord I, 100 m.

The Norw. North Atl. Exp. caught this species in Saltstrømmen.

Actinostola callosa, Verr.

Stønnesbotn, 40—80 m.; The Jøkel Fiord, 80—100 m.

This species was also observed in several other fiords, but no specimen was preserved.

Metridium dianthus, Ellis.

Kvænangen II, 90 m.

M. Sars in his account of his expedition in 1849 says that this form was commonly found between the pebbles on the beach in the Øx Fiord and at Hammerfest.

Chondrachtinia digitata, O. F. Müll.

The Øgs Fiord, 100 m.; Stønnesbotn, 40—80 m.; Malangen, 100—200 m.; The Jøkel Fiord I, 100 m.; The Porsanger Fiord, 200 m.

This form is very common in the fiords of Northern Norway.

Chondrachtinia nodosa, Fabr.

The Porsanger Fiord, 200 m. (3 specimens).

This is surely the first time that this genuine arctic species is noted from any Norwegian fiord. The Norw. North. Atl. Exp. collected it at St. 290 (between Norway and Beeren Eiland. Danielsen[1]) mentions it under the name of *Actinauge (Verrill) nodosa* Fabr.

Carlgren says in a written communication that he has numerous specimens of Fabricius' species from Greenland, Spitzbergen and Beeren Eiland. At the same time, he gives the important information that *Actinida nodosa*, Fabr. is not identical to the chief variety of *Actinauge nodosa*, Verrill. The latter has therefore since been named *Actinauge verrilli*. On the other hand, Carlgren declares that *Actinauge nodosa var. tuberculosa*, Verr. = *Chondrachtinia nodosa*. Fabr., which species is also found on the east coast of North America.

Epizoanthus erdmanni, Dan.

Malangen, 380 m.; Lyngen II, 280 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.

The Norw. North Atl. Exp. took this species at four different places.

Isozoanthus (Epizoanthus) arborescens, Dan.

Mortsund I, 200 m.; Tranødybet, 607—640 m.

Danielsen[2]) notes this species from St. 149 (The Vest Fiord). Carlgren has classified *Isozoanthus* as a new genus, which differs from *Parazoanthus* in wanting a ring sinus.

[1]) Actinida, p. 42.
[2]) Actinida, p. 129.

Crinoidea.[1])

James A. Grieg determ.

Rhizocrinus lofotensis, M. Sars.

Tranødybet, 640 m.; Øxsund, 600 m.; The Sag Fiord, 200 m.; Brettesnes, 350—400 m.; Reine, 150 m.; Moskenstrømmen, 200 m.

Antedon tenella, Retzius.

The Beier Fiord, 30—150 m.; The Skjerstad Fiord, 330—490 m.; The Tys Fiord, 500 m., Malangen, 100—200 m.

Ophiuroidea.

James A. Grieg determ.

Ophiura albida, Forbes.

The Salten Fiord, 15—20 m.; Grøtø, 4 m.; The Ostnes Fiord, 30 m.; The Trold Fiord, 40 m.

Ophiura sarsi, Lütken.

Numerous specimens both from the outer and inner fiord districts, 30—600 m., and on soft as well as hard bottom.

Ophiura robusta, Ayres.

The Skjerstad Fiord, on hydroids; The Ogs Fiord, 100 m.; The Kirk Fiord, 30—50 m.; The North Cape (1894).

Ophiura carnea, M. Sars.

The Sag Fiord, 100 m.

Ophiocten sericeum, Forbes.

Was seen at a number of stations, both out at sea and in the fiords, 100—160 m.

Amphilepis norvegica, Ljungman.

Landego, 300—400 m.; The Salten Fiord, 220—380 m.; The Folden Fiord, 530 m.; Øxsund, 600 m.; Brettesnes—Skroven, 350—400 m.; Tranødybet, 640 m.

Ophiopholis aculeata, Lin.

Exceedingly common at most of the stations, 10—700 m.

Ophiacantha bidentata, Retz.

Commonly distributed. Especially numerous in the Ogs Fiord, the Porsanger Fiord etc.

Ophiacantha abyssicola, G. O. Sars.

Sea NW of Røst, 300—500 m.

Ophiacantha spectabilis, G. O. Sars.

Arnø, 300—400 m.; The Tys Fiord, 500 m.; Tranødybet, 450—530 m.

Ophiotrix fragilis, O. F. Müller.

Røst, 100 m.

Ophioscolex glacialis, Müll. & Trosch.

The Skjerstad Fiord, 470—490 m.; The Salten Fiord, 220—380 m.; Landego, 200—400 m.; The Folden Fiord, 530 m.; The

[1]) Cfr. Grieg, Oversigt over det nordlige Norges echinodermer. Berg. Mus. Aarb. 1902, No. 1.

Sag Fiord, 200 m.; The Tys Fiord, 500 m.; Skroven, 200—400 m.; Kvænangen, 300—343 m.

Ophioscolex purpureus, DÜB. & KOR.

The Tys Fiord, 500 m.

Gorgonocephalus lamarcki, MÜLL. & TROSCH.

The Sea west of Ingø, 300 m.

Asteroidea.

JAMES A. GRIEG determ.

Pontaster tenuispinus, DÜB. & KOR.

From a number of stations between Salten Fiord and Malangen, 100—640 m.

Plutonaster parelii, DÜB. & KOR.

Balstad, 150 m.; The Folden Fiord, 530 m.; Svolvær (1894); Sværholt (1894).

Ctenodiscus crispatus, RETZ.

Of very common occurrence on the mud in the basins of the fiords betveen the Skjerstad and Porsanger fiords, 30—530 m.

Leptoptychaster arcticus, M. SARS.

From numerous stations, 30—400 m.

Astropecten irregularis, PENNANT.

Seivaagen (Salten Fiord), 15—17 m.

Psilaster andromeda, MÜLL. & TROSCH.

The Beier Fiord, 50 m.; The Skjerstad Fiord, 30—50 m.; Landego, 200—400 m.; The Folden Fiord, 530 m.; Mortsund (Vest Fiord), 200 m.; the mouth af Raftsund, 250—300 m.

Pentagonaster granularis, RETZ.

The Salten Fiord, 320—380 m.; The Østnes Fiord, 130 m.; Reine, 100 m., Mortsund, 200 m.; Balstad, 150 m.; Moskenstrømmen, 200 m.; Røst, 150 m.; Malangen, 100—200 m.; The North Cape (1894); Sværholt (1894).

Hippasterias phrygiana, PARELIUS.

The Skjerstad Fiord, 230 m.; Sværholt (1894).

Poraniamorpha rocea, DAN. & KOR.

The Folden Fiord, 530 m.

Solaster papposus, LIN.

The Skjerstad Fiord, 10—30 m.

Solaster endeca, RETZ.

Balstad, 30—70 m.; The Østnes Fiord, 30 m.

Solaster syrtensis, VERR.

The Beier Fiord, 50 m.

Pteraster pulvillus, M. SARS.

Henningsvær, 150 m.; Sværholt (1894).

Pteraster militaris, O. F. MÜLLER.

The Tys Fiord, 500 m.; Tranødybet, 450—530 m.; Reine (Vest Fiord); Sea W of Ingø, 300 m.; The Jøkel Fiord, 100 m.; Sværholt (1894).

Cribrella sanguinolenta, O. F. MÜLLER.

Common, especially on the Lofoten banks, 30—300 m.

Pedicellaster typicus, M. SARS.

Balstad (Vest Fiord), 80 m.

Stichaster roseus, O. F. MÜLLER.

The Østnes Fiord, 130 m.

Asterias glacialis, LIN.

Moskenstrømmen, 90 m.; The Kanstad Fiord, 30—90 m.; Breisund, 100 m.

Asterias mülleri, M. SARS.

Occurs from a number of stations between The Skjerstad Fiord and Sværholt, 10—250 m.

Asterias lincki, MÜLL. & TROSCH.

The Kanstad Fiord, 90 m.; The Jøkel Fiord, 60—100 m.

Asterias rubens, LIN.

From several localities in Lofoten.

Brisinga coronata, G. O. SARS.

The Folden Fiord, 530 m.

Echinoidea.

JAMES A. GRIEG determ.

Echinus norvegicus, DÜB. & KOR.

Moskenstrømmen, 200 m., Røst, 150 m.

Echinus elegans, DÜB. & KOR.

The Tys Fiord, 500 m.

Echinus esculentus, LIN.

Malangen, 100—200 m.

Strongylocentrotus droebachiensis, O. F. MÜLL.

From 13 places between Skjerstad Fiord and Sværholt.

Echinocyamus pusillus, O. F. MÜLL.

Skroven (Vest Fiord), 200—400 m.; Moskenstrømmen 90 m.; Røst, 100 m.

Schizaster fragilis, DÜB. & KOR.

Landego, 300—400 m.; The Kanstad Fiord, 30—90 m.; The Kirk Fiord, 70—100 m.; Malangen, 100—200 m.

Spatangus purpureus, O. F. MÜLL.

The Skjerstad Fiord, 330 m.; The Østnes Fiord; Moskenstrømmen, The North Cape (1884), Sværholt (1894).

Echinocardium cordatum, PENNANT.

Sværholt (1894).

Echinocardium flavescens, O. F. MÜLL.

The Salten Fiord, 15—20 m., Stene (Vest Fiord), 120—200 m.; Troldfiordsund, 40 m.; Sværholt (1894).

Holothurioidea.

Dr. Hjalmar Östergren, Upsala, determ.[1])

Stichopus tremulus, Gunnerus.

The Salten Fiord, 320—380 m.; Landego, 300—400 m.; Balstad, 150 m.; Balstad (13/4 1897), in the stomach of cod *(Gadus callarias)*.

Bathyplotes natans, M. Sars.

The Folden Fiord, 530 m.; Øxsund, 600 m.

Mesothuria intestenalis, Ascanius.

The Folden Fiord, 530 m.; Øxsund, 600 m.

Cucumaria frondosa, Gunnerus.

Balstad (1897); Reine, in the stomachs of cod *(Gadus callarias)*; Røst, in the stomachs of cod; Troldfiordsund, 30—40 m.

Cucumaria hispida, Barrett.

The Salten Fiord, 320—380 m.; Landego 300—400 m.; The Sag Fiord, 200 m.; Øxsund, 600 m.; Skroven, 200—400 m.; Brettesnes, 350—400 m.; Tranødybet, 607—640 m.

Phyllophorus pellucidus, Fleming.

Digermulen, 100—150 m.; Kvænangen, 90 m.; Røst, in the stomachs of haddock *(Gadus æglefinus)*.

Psolus phantapus, Strussenfeldt.

The S. Beier Fiord, 30—150 m.; The Østnes Fiord, 50—70 m.; Mehavn (1894).

Lapidoplax buski, M'Intosh.

The Kirk Fiord, 50 m.

Myriotrochus rinki, Steenstrup.

The Lyngen Fiord, 250 m.; Kvænangen, 300—343 m.; The Jøkel Fiord, 100 m.

Myriotrochus vitreus, M. Sars.

Brettesnes, 350—400 m.

Nemertinea.[2])

Dr. R. C. Punnett, Cambridge, determ.

Lineus scandinaviensis, Punnett, n. sp.

The Jøkel Fiord, 100 m.

Lineus cinereus, Punnett, n. sp.

The Tys Fiord, 500 m., on *Lophohelia*.

Eunemertes nordgaardi, Punnett, n. sp.

The Salten Fiord, 200 m.; Balstad, 150 m.

Amphiporus pusillus, Punnett, n. sp.

Lofoten (exact locality uncertain).

[1]) Cf. Östergren, The Holothurioidea of Northern Norway. Berg. Mus. Aarb. 1902.

[2]) A description of the new species here mentioned will be found in Dr. Punnett's treatise, On the Nemerteans of Norway. Bergens Mus. Aarb. 1903, Nr. 2.

Amphiporus magnus, Punnett, n. sp.

The Tys Fiord, 500 m.; on *Lophohelia prolifera*.

Amphiporus thompsoni, Punnett.

Balstad, 50 m.; The Porsanger Fiord, 200 m.

Drephanophorus borealis, Punnett.

The Lyngen Fiord II, 250 m.

Annelida.

Polychæta.

O. Bidenkap, Kristiania, and G. M. R. Levinsen, Copenhagen, determ. Remarks by the author.

Harmothoë oculinarum, Storm.

Gaukværø, 250 m.

The species had previously been known as distributed from Bømmeløen to The Trondhjem Fiord.

Harmothoë mollis, M. Sars.

Reine (Vest Fiord), 150 m.

According to Bidenkap[1]) this species is rare on the Norwegian coast.

Harmothoë rarispina, M. Sars.

The Skjerstad Fiord (S. XVI); Malangen, 100—200 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.; The Porsanger Fiord, 200 m.

Harmothoe propinqua, Malmgren.

Henningsværstrømmen, 20—40 m.

The northern limit for this species hitherto was The Trondhjem Fiord.

Harmothoë sarsi, Kinberg.

The Sag Fiord, 200 m.; Lyngen III, 300 m.; The Jøkel Fiord, 100 m.

Harmothoë nodosa, M. Sars.

Malangen, 100—200 m.; The Skjerstad Fiord, 10—20 m.; Breisund, 100 m.

Harmothoë imbricata, Lin.

Napstrømmen (Lofoten); Troldfiordsund, 40 m.; Sværholt (1894); The Kjølle Fiord (1894).

Harmothoë impar, Johnst.

The S. Beier Fiord, 50—150 m.; The Skjerstad Fiord, 230 m.; The Tys Fiord, 500 m.; Ingøhavet (hav = sea), 300 m.

Harmothoë clavigera, M. Sars.

The list of places where found is lost. The species has previously been caught near Christiansund by M. Sars and in The Trondhjem Fiord by Storm. I caught specimens in 1899, my district was then The Beier Fiord—The Porsanger Fiord. So that this species is also found north of the arctic circle.

[1]) O. Bidenkap, System. oversigt over Norges Annulata Polychæta. Krist. Vid. Selsk. Forh. 1894. No. 10.

Harmothoë asperrima, M. Sars.

Malangen, 100—200 m.

Hitherto the northern known limit for this species had been Bodø.

Lepidonotus squamatus, Lin.

Svolvær (1894); Napstrømmen (1897), 30—40 m.

Lepidonotus cirrosus, Pall.

The Beier Fiord, 50 m.; The Sag Fiord, 200 m.

Lepidonotus amondseni, Malmgren.

Stønnesbotn, 40—80 m.

The Trondhjem Fiord was previously the northern limit for this species.

Aphrodite aculeata, Lin.

Moskenstrømmen, 200 m.; Tranødybet, 607—640 m.

Laetmonice filicornis, Kinberg.

The Folden Fiord, 530 m.; Landego, 200—400 m.; Øxsund, 600 m.; The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Gaukværø, 250 m.; Malangen, 100—200 m.

Leanira tetragona, Kinb.

The Skjerstad Fiord (several places); The Salten Fiord, 200 m.; Landego, 200—400 m.; The Folden Fiord, 530 m.; Risvær, 150—180 m.; Malangen, 380 m.

Eumida sanguinea, Ørsted.

The Skjerstad, 20 m.

Phyllodoce maculata, Lin.

The Beier Fiord, 30—150 m.; The Skjerstad Fiord, 330 m.; The Salten Fiord, 15—20 m.; The Kirk Fiord, 70—80 m.; Sværholt (1894).

Eteone depressa, Malmgren.

The Kirk Fiord, 70—80 m.

This species is not mentioned in Bidenkap's list of the Polychæta of Norway. Later on, however, Bidenkap found a specimen at Horsnes in The Lyngen Fiord.[1]) It is known from Greenland, Spitzbergen and Novaja Semlja.

Nepthys malmgreni, Théel,

The Kanstad Fiord, 30—90 m.; Risværflaket, 150—180 m.; Gaukværø, 250 m.; Lyngen II, 250 m.; Kvænangen, 300—353 m.; The Jøkel Fiord, 80 m.

Nephtys incisa, Malmgren.

Svolvær (1894); Malangen, 380 m.; The Jøkel Fiord, 100 m.; Bidenkap mentions Lofoten as the northern limit, but this must now be changed to Kvænangen and the Jøkel Fiord.

Nephtys ciliata, Müller.

The S. Beier Fiord, 50 m.; Landego, 200—400 m.; Svolvær (1894); The Øgs Fiord, 100 m.; The Kirk Fiord, 50—40 m.; Digermulen, 100—150 m.; The Kanstad Fiord, 30—90 m.; Stønnesbotn, 40—80 m.; Malangen, 100—200 m.; Kvænangen, 300—343 m.; The Jøkel Fiord, 80 m.

[1]) Lyngenfjordens evertebratfauna. Tromsø Mus. Aarsh. 20, 1897, p. 95.

Nephtys coeca, Fabr.

The Beier Fiord, 30—150 m.; The Øgs Fiord I, 100 m.; mouth of Raftsundet, 250—300 m.; Svolvær (1894); Henningsvær I, 150 m.; The Kirk Fiord, 30—50 m.

Glycera capitata, Ørsted.

The Skjerstad Fiord X, 10—30 m.; Skroven, 200—400 m.; Røst II, 100 m.; Sværholt (1894).

Staurocephalus erucaeformis, Malmgren.

Balstad, 150 m.

Lumbrinereis fragilis, Müller.

The Kirk Fiord, 70 m.

Onuphis conchylega, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Østnes Fiord; The Kanstad Fiord, 30—90 m.; Lyngen III, 250 m.; The Jøkel Fiord, 100 m.; The Porsanger Fiord, 70 m.

Onuphis quadricuspis, M. Sars.

Ure I (Vest Fiord), 200—250 m.

Hyalinoecia tubicola, Müller.

Svolvær (1894).

Christiansund was the previously known northern limit.

Nereis pelagica, Lin.

The Skjerstad Fiord XIII, 110 m.; Troldfiordsund, 40 m.; Breisund, 100 m.; Sværholt (1894); The Kjølle Fiord (1894); Nordkyn (1894).

Leodice norvegica, Lin.

The Beier Fiord, 50 m.; The Skjerstad Fiord, 30—50 m.; The Tys Fiord I, 500 m.; The Kanstad Fiord, 30—90 m.; Digermulen, 100—200 m.; Henningsvær, 150 m.; Mortsund, 200 m.; Balstad, 150 m.; Røst II, 150 m.; Malangen, 100—200 m.; Kvænangen, 90 m.; Breisund, 100 m.; The Porsanger Fiord, 50 m.

Leodice gunneri, Storm.

The Tys Fiord I, 500 m.

? Cirratulus abranchiatus, Ar. Hansen.

The Jøkel Fiord II, 80 m.

Aricia kuppferi, Ehlers.

Landego, 200—400 m.

This species had previously on the coast of Norway only been found in The Bergen Fiord.

Trophonia plumosa, Müller.

Glea (Røst) on the beach; The Øgs Fiord; The Folden Fiord, 530 m.; The Jøkel Fiord; Kvænangen.

Brada villosa, Rathke.

The Skjerstad Fiord, 230 m.; The Salten Fiord I, 15—20 m.; The Folden Fiord, 530 m.

Brada granulosa, Armauer Hansen.

Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

The southern limit for this species must thus, for the present,

be considered to be Malangen. It is new for the fauna of Norway; the places at which The Norw. North Atl. Exp. found it all lie at a considerable distance from the Norwegian coast.

Brada granulata, Malmgren.

Glea (Røst) on the beach; Malangen 100—200 m.; Kvænangen.

Euphrosyne borealis, Ørsted.

Malangen, 100—200 m.

Spinther oniscoides, Johnst.

The Porsanger Fiord, 220 m.

According to a written communication from Mr. Levinsen, *S. oniscoides,* Johnst. = *S. major* Levinsen = *S. arcticus* Armauer Hansen.

Eumenia crassa, Ørsted.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 470—490 m.

Arenicola marina, Lin.

Sund (Beier Fiord) in sand on the beach.

Clymene praetermissa, Malmgren.

The Kirk Fiord, 100 m.; in large quantities. According to Malmgren, this species is common on clay bottom in Finmarken.

Nicomache lumbricalis, Malmgren.

The Skjerstad Fiord III, 130 m.; The Øgs Fiord I, 100 m.; Stønnesbotn, 40—80 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.

Maldane biceps, M. Sars.

The Skjerstad Fiord III, 230 m.; Landego, 200—400 m.

Pectinaria hyperborea, Malmgren.

The Skjerstad Fiord I, 30—50 m.; The Kirk Fiord III, 70—80 m.; The Østnes Fiord, The Øgs Fiord, 100 m.; The Jøkel Fiord, 100 m.

Pectinaria koreni, Malmgren.

Malangen, 380 m.

Bidenkap mentions this species only from the west and south coast of Norway. The northern limit must now be moved much higher, *viz.* right up to Malangen.

Terebellides strömi, M. Sars.

The Skjerstad Fiord, 230 m.; mouth of Raftsund, 250 m.; Malangen, 100—200 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.; The Jøkel Fiord II, 80 m.; The Porsanger Fiord, 70 m.

Artacama proboscidea, Malmgren.

Lyngen III, 300 m.

This species has not often been collected on the Norwegian coast. Prof. Esmark found it at Nakholmen in the Kristiania Fiord, and G. O. Sars at Lofoten.

Thelepus circinnatus, Fabr.

The Skjerstad Fiord IX, 40—50 m.; The Kirk Fiord IV, 30—50 m.; Napstrømmen, 30—40 m.; Henningsværstrømmen, 20—40 m.; Kvænangen, 90 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

Amphitrite cirrata, Müller.

Kvænangen, 90 m.; The Porsanger Fiord, 200 m.

Amphitrite groenlandica, Malmgren.

The Jøkel Fiord II, 80 m.

Bidenkap mentions that this species has rarely been found at Vadsø by M. Sars and G. O. Sars. Thus it is new from Vest Finmarken.

Terebella debilis, Malmgren.

The Østnes Fiord (1894).

Euchone papillosa, M. Sars.

Kvænangen, 300—343 m.

Chone infundibuliformis, Kröyer.

The Salten Fiord I, 15—20 m.; The Folden Fiord, 530 m.

Dasychone dalyelli, Kölliker.

Kvænangen, 90 m.

Bidenkap gives Bodø as the northern limit, this must now be altered to Kvænangen.

Sabella pavonia, Savigny.

The Sag Fiord, 200 m.; Gaukøvær, 250 m.; Malangen, 100—200 m.; The Jøkel Fiord II, 80 m.

Sabella fabricii, Kröyer.

Kvænangen, 90 m.

Potamilla neglecta, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord XVI, on *Hydroida;* The Jøkel Fiord II, 100 m.; Breisund, 100 m.

The hitherto known southern limit on the Norwegian coast for this species was Tromsø. It must now be changed to be Beier Fiord.

Potamilla reniformis, Müller.

Nordkyn (1894) in numbers.

Leptochone steenstrupi, Kröyer.

Svolvær (1894).

Filigrana implexa, Berkley.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 230 m.; Mortsund (Vest Fiord) 100 m.; Nordkyn (1894).

Pomatocerus triqueter, Mörch.

The Jøkel Fiord, 80 m.

Common on stones and shells.

Hydroides norvegica, Gunnerus.

Digermulen, 100—150 m.; Lyngen III, 300 m.

Common on stones and shells.

Placostegus tridentatus, Fabricius.

Gaukværø, 250 m.; The Jøkel Fiord, 100 m.; Hammerfest (1894).

Ditrupa arietina, Müller.

Röst I, 120 m.; Balstad, 150 m.; Stene (Vest Fiord), 200 m.; Ure I (Vest Fiord), 200—250 m.; Svolvær (1894); Gaukværø, 250 m.; Sværholt (1894).

Sternaspis fossor, SIMPSON.

The Beier Fiord, 50—150 m.

This is a new species of Norwegian fauna. LEVINSEN,[1]) who has classified my specimen from the Beier Fiord, gives it the following distribution: Iceland, Greenland and North America.

Gephyrea.

Echiurus pallasi, GUÉR.

Sund at the Morsdal Fiord, on the beach, several specimens (LEVINSEN determ.).

Bryozoa or Polyzoa.

Determ. by author.

Cheilostomata.

Gemellaria loricata, LIN.

The Trold Fiord Sund, 30—40 m.; Nordkyn, 30 m.

Menipea ternata, ELLIS and SOLANDER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 100—185 m.; Balstad (The Vest Fiord), 30—50 m.; Mortsund III (The Vest Fiord), 100 m.; Henningsværstrømmen, 20—40 m.; The Østnes Fiord, 130 m.; The Øgs Fiord I, 100 m.; Stønesbotn, 40—80 m.; The Trold Fiord Sund, 30—40 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

It was var. *gracilis* which occurred at most of the above mentioned places.

Menipea jeffreysi, NORMAN.

Mortsund III, 100 m.; Moskenstrømmen, 200 m.

Menipea normani, NORDGAARD.

The sea NW of Røst, 700 m.

This species is easily recognized by the pedunculate avicularia on the front wall.

Scrupocellaria scabra, I. VAN BENEDEN.

Balstad, 30—50 m.; Grøtø, 6—24 m.; The Kanstad Fiord, 30—90 m.; The Trold Fiord Sund, 30—40 m.; The North Cape (1894); Nordkyn (1894).

Caberea ellisi, FLEMING.

The Beier Fiord, 50—150 m.; Balstad (The Vest Fiord), 30—50 m.; The Østnes Fiord; Malangen, 100—200 m.; Stønesbotn, 40—80 m.; Kvænangen II, 90 m.; Ingøhavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.; Nordkyn (1894).

Bicellaria alderi, BUSK.

Moskenstrømmen, 200 m.; Reine I (The Vest Fiord), 150 m.; The Sea NW of Røst, 700 m.

Bugula elongata, NORDGAARD.

The Beier Fiord, 50—150 m.; Røst II, 150 m.; The Kirk Fiord III, 70—80 m.; Svolvær (1894); Malangen, 100—200 m.; Breisund, 100 m.; Mehavn (1894).

[1]) Cf. LEVINSEN, Systematisk-geografisk oversigt over de nordiske *Annulata, Gephyrea, Chætognathi* et *Balanoglossi.* Vid. Med. Nat. Foren. Kjøbenhavn, 1882 and 1883.

Bugula purpurotincta, NORMAN.

Malangen, 100—200 m.

Bugula murrayana, JOHNSTON.
Pl. III, fig. 8.

The Beier Fiord, 50—150 m.; Moskenstrømmen, 90 m.; The Kirk Fiord II, 50 m.; The Øgs Fiord I, 100 m.; Malangen, 100—200 m.; Stønesbotn, 40—80 m.; Breisund, 100 m.; The Trold Fiord Sund, 30—40 m.; The Porsanger Fiord, 200 m.; Nordkyn (1894).

Kinetoskias smitti, DAN. and KOREN.

The Østnes Fiord; The Øxsund, 100 m.; The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Malangen, 100—200 m.

Lofoten was the hitherto known northern limit for this species. It must now be changed to Malangen.

Cellaria fistulosa, LIN.

Moskenstrømmen, 90 m.; Malangen, 100—200 m. The northern limit is now moved from Lofoten to Malangen.

Flustra carbasea, ELLIS and SOLANDER.
Pl. III, fig. 1.

Balstad (The Vest Fiord), 100 m.; Svolvær (1894); Breisund, 100 m.; The Porsanger Fiord, 200 m.; Mehavn (1894).

Flustra securifrons, PALLAS.
Pl. III, fig. 2.

Røst II, 150 m.; Moskenstrømmen, 90 m.; Mortsund (The Vest Fiord), 100 m.; Malangen, 100—200 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.; Vardø (on *Pecten islandicus).*

Flustra membranaceo-truncata, SMITT.
Pl. III, figs. 3, 4.

The Skjerstad Fiord XVI; The Skjerstad Fiord III, 230 m.; The Øgs Fiord I, 100 m.; Malangen, 100—200 m.; The Trold Fiord Sund, 30—40 m.; The North Cape (1894).

Flustra barleei, BUSK.
Pl. III, figs. 5, 6.

Røst II, 150 m.; Arnø (The Vest Fiord), 300—400 m.

Flustra abyssicola, M. SARS.
Pl. III, Fig. 7.

The sea NW of Røst, 700 m.; Reine (The Vest Fiord), 100 m.; Balstad (The Vest Fiord), 150 m.; Mortsund (The Vest Fiord), 100 m.; Brettesnes—Skroven, 350—400 m.; The Øx Sund, 600 m.; The Sag Fiord, 200 m.

Membranipora[1]) *pilosa,* LIN.

Napstrømmen (Lofoten), 10 m.; Svolvær (on algae), Grøtø (on algae); The Trold Fiord Sund (on algae).

Membranipora membranacea, LIN.

The Trold Fiord Sund, 30—40 m., on algae; Nordkyn, on *Laminaria.*

[1]) NORMAN, in his work Notes on the Natural History of East Finmark (Ann. Mag. Nat. Hist., Ser. 7, Vol. XI), has divided the genus *Membranipora* into several others. I have not yet had time, however, to form a definite opinion about this division, so I prefer here to retain the old nomenclature.

Membranipora lineata, LIN.

Hammerfest (1894).

Membranipora arctica, D'ORBIGNY.

Kvænangen, on algae; The North Cape (1894); Nordkyn (1894).

Membranipora craticula, ALDER.

On an ascidian near Hammerfest (1894); The Lakse Fiord (collected by SPARRE SCHNEIDER).

Membranipora cymbaeformis, HINCKS.

The North Cape (1894) on algae.

Membranipora trifolium, S. WOOD.

The Østnes Fiord, 50—70 m.; Digermulen, 100—150 m.; Stønesbotn, 40—80 m.; The Jøkel Fiord III, 100 m.; Hammerfest (1894).

Membranipora minax, BUSK.
Pl. III, fig. 11).

Røst II, 150 m., on *Waldheimia;* Moskenstrømmen II, 150 m., on *Waldheimia;* Digermulen, 100—150 m., on stone; Malangen, 100—200 m., on *Waldheimia.*

Lepralia (Membraniporella) nitida, JOHNSTON.[1])

Røst II, 150 m.; Nordkyn (1894).

Gephyrotes (Cribrilina) nitido-punctata, SMITT.

Moskenstrømmen II, 150 m.; Nordkyn (1894). LOVÉN had specimens from Hammerfest.

Cribrilina cryptooecium, NORMAN.[2])

The Kjølle Fiord (1894); Nordkyn (1894).

Cribrilina annulata, FABR.

The North Cape (1894).

Microporella ciliata, PALLAS.

Svolvær (1894), Sværholt (1894).

Microporella impressa, AUDOUIN.

Ingøhavet, 300 m., on stones; Breisund, 100 m., on stones.

Doryporella[3]) *spatulifera*, SMITT.

Breisund, 100 m., on *Rhynchonella psittacea.* An excellent illustration of the zooecia in this peculiar species, will be found in WATERS (Bryozoa from Franz-Josef Land. Journ. Linn. Soc., XXVIII, pl. 12, fig. 6).

Harmeria[4]) *scutulata*, BUSK.

Nordkyn (1894), on stones.

Tessarodoma gracile, M. SARS.

Mortsund III, 100 m.; Digermulen, 100—150 m.; The Sag Fiord, 200 m., on dead branches of *Isidella hippuris;* Tranødybet, 607—640 m., on dead branches of *Isidella hippuris;* Malangen, 100—200 m.; Ingøhavet, 300 m.

[1]) Cfr. NORMAN, Finmark Polyzoa, p. 100.
[2]) Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist., Ser. 7, Vol. XII, p. 102.
[3]) NORMAN, Finmark Polyzoa, p. 106.
[4]) NORMAN, Finmark Polyzoa, p. 107.

Porina tubulosa, NORMAN.

Hammerfest (1894); The Lakse Fiord (collected by SPARRE-SCHNEIDER).

Hippothoa hyalina, LIN.

Grøtø, 6—24 m., on algae; The Trold Fiord Sund, 30—40 m., on algae; Breisund, 100 m., on an ascidian. This species has sometimes been mentioned as a *Schizoporella*, sometimes as a *Celleporella.*

Hippothoa divaricata, LAMOUROUX.

Tromsø (collected by SCHNEIDER); The Lakse Fiord (collected by SCHNEIDER).

Schizoporella alderi, BUSK.

Moskenstrømmen, 90 m., on stones; The Østnes Fiord, 50—70 m.; Hammerfest (1894); Ingøhavet, 300 m.; Sværholt (1894).

Schizoporella sinuosa, BUSK.
Pl. III, figs. 9, 10.

Moskenstrømmen, 90 m., on stones and *Waldheimia;* The Østnes Fiord, 50—70 m., on stones and coal; Digermulen, 100—150 m., on stones; Malangen, 100—200 m., on *Modiola modiolus.* Operculum (cfr. fig. 10) presents a divergent appearance from the genus *Schizoporella*, and the species *sinuosa* ought indeed to be removed.

Schizoporella linearis, HASSALL.
Pl. V, fig. 26.

Moskenstrømmen, 90 m., on shells.

Schizoporella unicornis, JOHNSTON.
Pl. V, figs. 23—25, 27.

„Glea" (Røst), on the beach.

The specimens from Røst differ somewhat from those I have collected in the Hjelte Fiord, near Bergen, but the variations are not so great as to make a new species necessary. Besides fig. 23 agrees well with HINCKS' figures in Brit. Mar. Pol.

On comparing opercula[1]) of *Schizoporella unicornis* from the Hjelte Fiord and from Røst, it was found that those from the latter place were somewhat larger. (Cfr. figs. 24, 27). The zooecia in the specimens from Røst also had a rather wider sinus on the proximal edge of the oral aperture. The species has a wide distribution and probably varies very considerably. Lofoten is up to the present the northern known limit, both for *unicornis* and *linearis.*

Schizoporella candida, SMITT.
Pl. IV figs 6, 7.

Mollia vulgaris, forma candida, SMITT. Öfvers. Kgl. Vet. Akad. Forh. 1867 (Bihang) pp. 16, 107, pl. 25, fig. 83.

[1]) It is practical to measure the maximum breadth (b, pl. V, figs. 26, 27) and the maximum height (h), when comparing opercula. These measurements may also be found useful in determining species, for, not taking their absolute value into account, in some species b will be larger than h (b > h), in others they will be equal in size (b = h) and in others less (b < h). It is also sometimes useful to take similar measurements of the maximum breadth and height of the mandibles.

Malangen, 100—200 m., on stone; Hammerfest (1894) on stone.

I have not had any opportunity of seeing Stimpson's work (Invertebr. of Gr. Manan), so that I am unable to form any opinion as to the correctness of Smitt's conclusion that his f. *candida* is the form described by Stimpson as *Lepralia candida*. But as Verriel[1]) classifies Stimpson's species as a *Smittia*, and also remarks that „this species has been entirely misunderstood by Smitt and others owing to the imperfection of the original description", it is certainly safest to give Smitt's form the designation which I have used here.

Schizoporella stormi, n. sp.
Pl. V, figs. 1, 2.

On a stone form the North Cape (1894), a Schizoporella was found, which I suppose to be a new species. The zooecia, which were rather broad in proportion to their length, had a single row of pores along the margin, together with a few small pores on the frontal side (cf. fig. 1). No ooecia were present in the colonies, but large avicularia were found under and a little to the side of the oral aperture. The mandible was very pointed. The surface of the zooecia was finely granulated and had weak radial stripes. The zooecia were separated by distinct lines, and it may be mentioned as a peculiarity that there is a crossline (l, fig. 1) by the oral aperture. I think the species will easily be kept distinct from others on account of the distinct opercular ribs (o. r., fig. 2). I have this species both from the North Cape and Hammerfest.

I have taken the liberty of naming this species after the manager of the zoological collection, V. Storm, in Trondhjem.

Schizoporella hexagona, n. sp.
Pl. V, figs. 12, 13.

Formed a little crust on stone from Kvænangen II, 90 m.

It is possibly this species which Smitt has illustrated on pl. 25, fig. 79[2]) under the name of *Mollia vulgaris*, forma *ansata*.

It is easily recognized by its six-sided zooecia whose frontwall is punctured, but not perforated. The zooecia are separated by distinct lines. On my specimen there were neither oociea nor avicularia.

A characteristic feature of this species is the large proximal lobe of the eperculum (fig. 13). In the operculum b < h.

Schizoporella levinseni, n. sp.
Pl. V, figs. 3, 4.

Kvænangen II, 90 m., on stone.

The zoarium formed a crust on a stone. In a dried state, the majority of the zooecia were of a deep red colour. The zooecia have a few pores on the frontal wall, and between the pores there are hollows (reminding one of a thimble). The ooecia, which are nearly ball shaped, are furnished with deeper hollows, but are not pierced. There were no avicularia on the colonies which I have had an opportunity of examining. The proximal border of the oral aperture is straight with a marked sinus in the middle.

The operculum has a lobe which answers exactly to the sinus mentioned (fig. 4). In the operculum b > h.

I have taken the liberty of calling this species after the Inspector of the Museum in Copenhagen, G. M. R. Levinsen.

Schizoporella reticulato-punctata, Hincks.
Pl. IV, figs. 16, 17.

1867. *Escharella porifera*, forma *edentata*, Smitt, Krit. Förteckn. etc. Öfv. Kgl. Vet. Akad. Förh. 1867. (Bihang), p. 9, pl. 24, fig. 39.
1877. *Lepralia reticulato-punctata*, Hincks, Polyzoa from Iceland and Labrador. Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 103, pl. 10, figs. 3, 4.
1884. *Lepralia reticulato-punctata*, Lorenz, Bryozoen von Jan Mayen, p. 88.
1887. *Escharella reticulato-punctata*, Levinsen, Dijmphna Togtets zool-bot. Udbytte, p. 318, pl. 27, fig. 4.
1895. *Smittia reticulato-punctata*, Nordgaard, Syst. fort., Berg. Mus. Aarb. 1894—95, No. II, p. 27.
1897. *Smittia reticulato-punctata*, Bidenkap, Bryozoen von Ost-Spitzbergen. Zool. Jahrb., vol. 10, p. 623.
1900. *Schizoporella harmsworthi*, Waters, Bryozoa from Franz Josef Land. Journ. Linn. Soc. Zool., vol. 28, p. 65, pl. 9, figs. 10—12.
1903. *„Lepralia" reticulato-punctata*, Norman, Notes on the Nat. Hist. of East Finmark. Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 122.

Hammerfest (1894); the North Cape (1894); the Porsangerfjord, 200 m., Nordkyn (1894).

In my list of Norwegian *Cheilostomata* I entered this species as a *Smittia*, but on closer examination it became clear that the species cannot be left there. Neither can it be considered to be a *Lepralia*, as Hincks does.

I at first thought of setting it up as the type for a new genus, together with Smitt's *Escharella porifera*, forma *typica* and the one which I described as *Smittia lineata*, but on further consideration, I have not ventured to start a new genus. In all three species mentioned, there is a distinct sinus on the proximal margin of the oral aperture, and notwithstanding that the opercula in these three species vary from that which is usual in the genus Schizoporella, they have, however, at any rate a trace of a proximal lobe. Waters has described a form, *Schizoporella harmsworthi*, from Franz Josef Land, which he has identified with Smitt's *Escharella legentili*, forma *prototypa*. This can hardly be correct. True, the mouth in young zooecia of forma *prototypa* may bear a certain resemblance to the oral aperture in Waters' species, but there is a great difference in the developed zooecia, *harmsworthi* having a sinus on the proximal margin (cfr. Waters l. c. pl. 9, fig. 10), while forma *prototypa* has a mucro (cfr. Bidenkap, Bryozoen v. Ost Spitzbergen, pl. 25, fig. 3, and also the present work pl. IV, fig. 24).

Besides, in *harmsworthi* the ooecia are perforated (cfr. Waters, pl. 9, fig. 10), while in f. *prototypa* they are provided with hollows, reminding one of a thimble. On the other hand, there seems to be complete resemblance between *harmsworthi* and Smitt's *Escharella porifera*, forma *edentata*, but as this form was raised to the rank of a species by Hincks in 1877, *harmsworthi* must give way to *reticulato-punctata* which form I consider, as does also Waters, to be a *Schizoporella*. In one specimen from the Porsanger Fiord, I could plainly see the oral glands at the opening of the tentacular sheath, as illustrated by Waters.

[1]) Proc. U. S. N. M., Vol. II, 1879, p. 192.

[2]) Krit. Förteckn. Övers. Kgl. Vet. Akad. Förh. 1867 (Bihang).

Schizoporella porifera, SMITT.

Pl. V, fig. 32.

Escharella porifera, forma *typica*, SMITT. Krit. förteckn., Öfvers. Kgl. Vet. Akad. Förh. 1867 (Bihang), p. 9, pl. 24, figs. 30—32.

As to other synonyms, cfr. NORMAN, Notes on the Nat. Hist. of East Finmark, p. 121.

Napstrømmen (Lofoten), 30—40 m.; Malangen, 100—200 m.; The Jøkel Fiord II, 80 m.; Hammerfest (1894); The Kjølle Fiord (1894); Mehavn (1894).

Both the shape of the mouth and the operculum with its proximal lobe, prove that there is a relationship to *Schizoporella*, (Pl. V, fig. 32). It must, at any rate, be more correct to classify this species as a *Schizoporella* than as a *Smittina* or *Eschara (Lepralia)*. The southern limit of the species which has been found up to the present is Lofoten; its distribution is arctic.

Schizoporella lineata, NORDGAARD.

Pl. V, figs. 33, 34.

1895. *Smittia lineata*, NORDGAARD, System. fortegn. Bergens Mus. Aarb. 1894—95, nr. 2, p. 27, pl. 2, fig. 2.

1903. „*Smittia*" *lineata*, NORMAN, Notes on the Nat. Hist. of East Finmark, Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 122, pl. 9, figs. 14, 15.

Nordkyn (1894).

NORMAN has taken this species in East Finmark, on *Escharopsis rosacea*, dredged off Vadsø. He remarks also (l. c.): — „Other specimens in my collection are one received from SMITT taken at Spitzbergen, and named *Escharella auriculata;* others from the Gulf of St. Lawrence (WHITEAVES), and off Holsteinborg, Greenland, in 57 fathoms."

From this it will be seen that *lineata* has an arctic distribution, and it is probable that what has been stated to be *Schizoporella auriculata*, HASSAL from these latitudes should be transferred to *lineata*. The two species appear to be very closely allied, so that it is easily explained that the arctic form *(lineata)* is confused with the more southern one *(auriculata)*.

Leieschara coarctata, M. SARS.

Moskenstrømmen, 90 m.; Malangen, 100--200 m.; Kvænangen II, 90 m.

Leieschara plana, DAWSON.

The Jøkel Fiord II, 80 m.; Kvænangen, Sværholt (1894).

NORMAN[1]) has made it clear that *Myriozoum crustaceum*, SMITT = *Lepralia plana*, DAWSON. WATERS is[2]) probably right in placing this species under the genus *Schizoporella*.

Eschara polita, NORMAN.

Lepralia polita, NORMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 87, pl. 11, fig. 1.

Hammerfest (1894), on stone.

In his work on „the Polyzoa of East Finmark", from which several quotations are taken in this paper, NORMAN has given the reasons for substituting *Eschara* for HINCKS' genus *Lepralia*. The synonyms for *Lepralia polita* may be found in my paper: — „Die Bryozoen des westlichen Norwegens". Die Meeresfauna von Bergen, p. 87.

1) Finmark Pol., p. 110.

2) Bryozoa from F. Josef Land, p. 64.

Eschara moskensis, n. sp.

Pl. IV, figs. 3—5.

Moskenstrømmen II, on stone, 150 m.

This species is particularly noticeable on account of its large, wide zooecia (fig. 3), which are scantily pierced with small holes in the sides. The oral aperture is partly surrounded by 4—6 short spines. On the surface of the ooecium (fig. 4) there are fine punctures, but they are not pierced through. The operculum (fig. 5) is quite solid, and the muscle insertions are very distinct.

It is probable that SMITT[1]) has this form in his paper of 1871, under the name *Discopora megastoma*, for fig. 26 shows no slight resemblance to the above mentioned species. I have, however, given a new name, as I consider that SMITT's *Discopora megastoma* includes two species, neither of them being identical to *Lepralia megastoma*, BUSK. (Cfr. SMITT's illustrations and description just quoted with Crag Polyzoa, p. 55, pl. 8, fig. 5).

Eschara nordlandica, n. sp.

Pl. IV, figs. 32—35.

Kvænangen II, 90 m., on stone.

The zooecia large, but not so broad as in the preceding species. The front wall is perforated by conspicuous pores and there are no spines on the edge of the oral aperture. Under the aperture there is a protrusion (umbo). There are raised lines between the zooecia (fig. 32) nearly all over. The ooecia are punctured, but not perforated. The operculum is quite solid and has distinct ribs (fig. 35). In fig. 33, it may be seen how these ribs lie against the condyles of the oral aperture.

It is not improbable that this species is included under SMITT's definition *Discopora megastoma*. In SMITT's paper of 1871, the figs. 24, 25 show no little resemblance to the above mentioned species. In his description (l. c., p. 1129), SMITT also mentions a protusion at the front of the zooecium. But there are hardly sufficient grounds for supposing that this species is identical to *Lepralia megastoma*, BUSK. His species has, for instance, „a single row of channelled pores".[2]) On the other hand, there is a stronger resemblance between *Eschara nordlandica* and *Eschara (Lepralia) pertusa*, *Esper*, according to HINCKS' characterisation of this species in Brit. Mar. Pol. (1888), p. 305, pl. 43, figs. 4, 5. But the shape of the oral aperture seems to be different, as well as the puncturing of the ooecia. I think it is quite justifiable to enter it as a new species, for I share the opinion that less harm is done by introducing a new name for a known species than by classing two different species under an old name.

The name *Lepralia megastoma* is used, in addition to the places above mentioned, also by LORENZ[3]) and BIDENKAP[4]), the latter also mentions the species as being a Mucronella. BIDENKAP remarks that „die stark verkalkten Zooecien haben die ganze Vorderseite mit grossen Poren durchlöchert", from which it appears extremely likely that the species, which BIDENKAP had before him (from Spitzbergen) was *E. nordlandica*.

1) Övers. Kgl. Vet. Akad. Förh., 1871, p. 1129, pl. 21, figs. 24—26.

2) Crag Pol., p. 55. Cfr. pl. 8, fig. 5.

3) Bryozoen von JAN MAYEN. Beobachtungsergebnisse der östreich. Polarstation Jan Mayen, III B., p. 89.

4) Fauna arctica (von RÖMER u. SCHAUDINN), B. I, p. 521.

Eschara sincera, Smitt.
Pl. III, figs. 12—14.

Balstad (Lofoten); The Østnes Fiord, 50—70 m., on coal; Digermulen, 150 m., on stone; The Lyngen Fiord, 250 m.; The Jøkel Fiord II, 80 m.; The North Cape (1894); Mehavn (1894).

I have previously classified this species as belonging to the genus *Mucronella,* and although, I now enter it as an *Eschara,* it is not at all because it can be said to be any typical form of this genus.

Discopora (Umbonula) verrucosa, Esper.

In the beach at „Glea", Røst.

I have previously found this interesting form near Bergen. The northern limit for the species is henceforth Lofoten.

Discopora (Mucronella) pavonella, Alder.[1])

The Kirk Fiord, 100 m.; The Trold Fiord Sund, 40 m.; Sværholt (1894). From Sparre Schneider I have received colonies which he took in the Lakse Fiord.

Porella minuta, Norman.

Grøtø, 6—24 m., on algae.

Norman was the first to find this species in Norway, he took it in the Bøg Fiord and the Lang Fiord (East Finmark).

Porella concinna, Busk.

Breisund, 100 m., on *Rhynchonella psittacea;* Mehavn (1894), on shells.

Porella aperta, Boeck.[2])

The Beier Fiord, 30—150 m., on *Pecten vitreus.*

Porella acutirostris, Smitt.[3])

Svolvær (1894), on coal from the bottom.

The species is a new one to our fauna.

Porella princeps, Norman.
Pl. IV, figs. 21—23.

1892. *Monoporella spinulifera,* var. *praeclara,* Hincks, „The Polyzoa of St. Lawrence". Ann. and Mag. Nat. Hist., ser. 6, vol. 9, p. 152, pl. 8, fig. 3.

1903. *Porella princeps,* Norman, „Notes on the Natural History of East Finmark". Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 114, pl. 9, figs. 8—11.

In the work already mentioned of Norman, he has availed himself of the opportunity of describing „a Greenland *Porella*", to which he has given the name above. This species has now also been shown to be European; for on looking through some dried material from Mehavn (Finmark, 1894), I found a little red colony on *Neptunea despecta.* There is perfect agreement with Norman's description, but so as to prevent any doubt with regard to identity, I have illustrated the characteristic operculum (Pl. IV, fig. 21).

Below the oral aperture of the zooecium, a swelling is indicated, both in Hincks' and Norman's figures. Below the swollen frontal wall is the chamber of the avicularium. From this chamber a passage goes to the lateral walls. (Pl. IV, fig. 23). The mandible of the avicularium is very small. (Pl. IV, fig. 22).

This species has previously been mentioned from St. Lawrence (Hincks). Norman speaks of it (l. c., p. 115) as being „taken by the Valorous", 1875, off Holsteinborg, W. Greenland, „in 57 fathoms". Mehavn in Finmark now comes as a third locality. I have also found a little colony on a stone from Hammerfest (1894).

Porella glaciata, Waters.
Pl. V, fig. 5—7.

1868. *Eschara cervicornis,* forma *lepraliae,* Smitt, Öfv. Kgl. Vet. Akad. Förh. 1867 (Bihang), p. 23, pl. 26, figs. 136, 137.

1900. *Porella glaciata,* Waters, Bryozoa from Franz Josef Land. Journ. Linn. Soc. Zool. Vol. 28, p. 78, text figure 2, 3.

Mehavn (1894), on *Neptunea despecta.*

As a synonym for his *Porella glaciata,* Waters adds, in the work above referred to, the designation, followed by a note of interrogation, *Eschara cervircornis,* f. *lepraliae,* Smitt.

Waters remarks (l. c. p. 78): — „The peristome is raised at the side, the avicularian chamber is wide and distinct with the mandible within the peristome, but on the top of a more or less tubular projection." If this belongs to the description of *glaciata,* it is not correct. But, on the other hand, this description is applicable to *Porella propinqua.* I have no doubt that Smitt's forma *lepraliae* and Waters' *glaciata* are identical. It also seems to be certain that it was *glaciata* which I took at Mehavn in Finmark. Smitt's specimens were from Greenland, so that the distribution of the species as at present known is: — Greenland, Finmark, Franz Josef Land.

Porella struma, Norman.

Balstad (Lofoten), 80 m.; Digermulen, 150 m.; Malangen, 100—200 m.; The Jøkel Fiord, 100 m.; Ingøhavet, 300 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

Porella lævis, Fleming.
Pl. III, fig. 15.

Moskenstrømmen, 90 m.; Balstad, 150 m.; Mortsund III, 100 m.; Malangen, 100—200 m.; The North Cape (1894).

Porella saccata, Busk.[1])
Pl. III, fig. 16.

Breisund, 100 m.; The North Cape (1894); The Porsanger Fiord, 200 m.

Porella propinqua, Smitt.
Pl. IV, figs. 18—20 b.

Eschara propinqua, Smitt (part.), Öfvers. af Kgl. Vet. Akad. Förh., 1867 (Bihang), pp. 22, 146, pl. 26, figs. 126—129.

Lepralia propinqua, Hincks, Polyzoa from Iceland and Labrador. Ann. Mag. Nat. Hist., ser. 4, vol. 19, p. 103, pl. 10, figs. 5—7.

Smittia propinqua, Nordgaard, Syst. fortegn. marine polyzoa, p. 27. Berg. Mus. Aarbog, 1894—1895.

Smittia propinqua, Bidenkap, Bryozoen von Ost-Spitzbergen, Zool. Jahrbücher, B. 10, 1897, p. 624.

Smittia propinqua, Bidenkap, Die Bryozoen, II. Theil. Fauna arctica (von Römer und Schandinn), B. I, p. 518.

Hammerfest (1894), on hydroids and *Bugula murrayana;* The North Cape (1894), on hydroids and *Menipea;* Mehavn (1894).

[1]) Cfr. S. F. Harmer, On the Morphology of the Cheilostomata. Quart. Journ. Mic. Sci. Vol. 46, N. S., p. 296.

[2]) Cfr. Norman, Finmark Polyzoa, p. 112 and Waters, F. J. B., p. 83, pl. 10, figs. 6, 7.

[3]) Cfr. Waters, F. J. B., p. 83, pl. 10, figs. 1—5.

[1]) Cfr. Waters, F. J. B.; p. 81.

Under the name *Eschara propinqua,* SMITT has entered two forms which undoubtedly are separate species. In the explanation of the illustrations it is mentioned that figs. 131—134 represent zooecia of specimens found in Finmark on *Flustra.* These belong to the species which HINCKS later described as *Porella proboscidea.* In the latter species, the zooecium is unperforated, while it has a characteristic perforation (Pl. IV, fig. 20 b) in *propinqua.*

In *propinqua* the peristome is very elevated on the sides of the oral aperture, and the operculum has a characteristic shape (20 b). Another peculiarity of *propinqua* is the occurrence of small perforations on the backside of the zoarium (fig. 19).

The lateral wall of the zooecium has two multipored rosette-plates.

Porella proboscidea, HINCKS.
Pl. IV, figs. 8—11.

Eschara propinqua, SMITT (part), Öfvers. Kgl. Vet. Akad. Förh. 1867 (Bihang), p. 22, pl. 26, figs. 130—134.

Porella proboscidea, HINCKS, The Polyzoa of the St. Lawrence. Ann. Mag. Nat. Hist., ser. 6, vol. 1, p. 223, pl. 14, fig. 4.

Porella proboscidea, NORDGAARD, Syst. forteg. marine polyzoa. Berg. Mus. Aarb. 1894—95, p. 25, pl. 1, fig. 4.

Porella skenei, var. *proboscidea,* WATERS. F. J. B., p. 79, pl. 11, figs. 17, 18.

Hammerfest (1894); The North Cape (1894); Nordkyn (1894); Mehavn (1894).

The avicularian rostrum is much larger in this species than in the foregoing one. (Cfr. figs. 8 and 18).

The Zooecium is poreless, and so is the basal wall of the zooecium.

The opercula are also different with regard to shape. *Proboscidea* is so different from *skenei* that the former can scarcely be considered to be a variety of the latter.

Palmicellaria skenei var. *tridens,* BUSK.
Pl. IV, fig. 12.

Moskenstrømmen, 90 m.; Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

With regard to this variety, I beg to refer to my paper: — Die Bryozoen des westlichen Norwegens. Meeresfauna von Bergen, p. 89.

The operculum is, however, not very carefully illustrated there (pl. I, fig. 14), for which reason I give another illustration here (fig. 12).

Palmicellaria skenei var. *bicornis,* BUSK.
Pl. IV, fig. 13.

Lepralia bicornis, BUSK, A Mon. of the foss. Pol. of the Crag, p. 47, pl. 8, figs. 6, 7.

The Jøkel Fiord III, 100 m.

I have also taken this variety in the Trondhjem Fiord.

Escharopsis (Escharoides) sarsi, SMITT.

Tromsø Sound, 70 m.

From SPARRE SCHNEIDER, I got a colony which was 17.5 cm. in length and 8 cm. in width.

The cavity of the colony served as a hidingplace for *Ophiopholis aculeata, Cribrella* etc. The colony itself was covered with *Thuiaria thuia* and other hydroids.

Escharopsis rosacea, BUSK.
Pl. III, fig. 17.

Moskenstrømmen, 90 m.; Digermulen, 100—150 m.; Malangen, 100—200 m.; Kvænangen II. 90 m.: Breisund. 100 m.

Pseudoflustra solida, STIMPSON.[1])

Kvænangen II, 90 m.; The Porsanger Fiord. 70 m.

Monoporella spinulifera, HINCKS.[2])
Pl. IV, figs. 14, 15.

Porina ciliata, forma dura, SMITT, Öfvers. af Kgl. Vet. Akad. Förh. 1867 (Bihang) pp. 6, 61, pl. 24, fig. 17.

Discopora cruenta, SMITT, Öfvers. af Kgl. Vet. Akad. Förh. 1871, p. 1127, pl. 21, figs. 20—23.

In my list of the Norwegian Bryozoa (Bergens Mus. Aarb. 1894—95). I have entered this species as *Mucronella cruenta,* NORMAN, as I, with SMITT took NORMAN'S *Lepralia cruenta* to be the same as *Discopora cruenta,* SMITT. I had, however, noticed at that time that there was a resemblance between *Discopora cruenta,* SMITT and *Mucronella spinulifera,* HINCKS. The identity of these two forms has later been confirmed by HINCKS and NORMAN. It must, however, be observed that SMITT both mentions and illustrates a single row of marginal pores on the zooecia, while HINCKS[3]) does not even hint at their presence. In other respects the resemblance is striking, and the only possible explanation is that HINCKS has overlooked the marginal pores. On Pl. IV, fig. 15 the arrangement of the marginal pore-chambers will be seen.[4])

The species is known from St. Lawrence. Greenland, Spitzbergen and King Charles' Land.[5]) I found it to be quite common on stones at Hammerfest in 1894.

Escharella immersa, FLEMING = *Mucronella (Lepralia) peachi,* JOHNSTON.[6])
Pl. IV, fig. 27.

Moskenstrømmen II, 150 m.; Malangen, 100—200 m. (var. *octodentata).*

Escharella ventricosa, HASSALL.
Pl. IV, fig. 28.

Moskenstrømmen II, 150 m.; Svolvær (1894), on coal; The Östnes Fiord, 50—70 m.. on stone and shells, Hammerfest (1894) on stones.

Escharella laqueata, NORMAN.
Pl. IV, fig. 29.

Moskenstrømmen II, 150 m.; The Östnes Fiord 50—70 m., on stone; Malangen, 100—200 m., on stone, Hammerfest (1894).

Escharella abyssicola, NORMAN.
Pl. IV, fig. 30.

The Tys Fiord I, 500 m., on *Lophohelia prolifera;* Kvænangen II, 90 m., on shells.

---

1) Refer to NORMAN (l. c. p. 124) for synonyms.
2) Cf. NORMAN (l. c. p. 115).
3) The Polyzoa of St. Lawrence. Ann. and Mag. Nat. Hist., ser. 6, vol. 3, p. 431, pl. 21, fig. 3.
4) Cfr. LEVINSEN, Studies on Bryozoa. Vid. Med. Nat. Hist. Foren. in Copenhagen, 1902, (Sep.), p. 10.
5) Cfr. BIDENKAP, „Die Bryozoen". Fauna Arctica, B. I, Lief. 3, p. 521.
6) Cfr. NORMAN (l. c. p. 118).

Escharella labiata, Boeck.
Pl. IV, figs. 25, 26, 31.

The Beier Fiord, 50—150 m.; The Kirk Fiord III, 70—80 m.; Svolvær (1894), on coal; Malangen, 100—200 m., on *Retepora cellulosa;* The Jøkel Fiord II, 80 m.; Breisund, 100 m., on *Retepora cellulosa;* The Porsanger Fiord, 200 m.; Sværholt (1894); Mehavn (1894).

In this species the basis of the ooecium is perforated (fig. 26). *Labiata* is different from *abyssicola* in that it has several rows of marginal pores (fig. 25).

The Norwegian species of this genus can fairly easily be distinguished by the help of the oral denticle, as this varies both in form and size in the species which I have had an opportunity of examining (figs. 27—31).

Phylactella peristomata, n. sp.
Pl. V, figs. 28—31.

The Jøkel Fiord II, 80 m., on *Waldheimia.*

The genus *Phylactella* was started by Hincks, and it is characterized as follows in the Brit. Mar. Pol. (p. 356): — „Zooecia with the primary orifice more or less semicircular, the lower margin usually dentate; peristome much elevated, not produced or channelled in front. No avicularia. Zoarium (in British species) incrusting."

As belonging to the British fauna, Hincks mentions three species, *labrosa, collaris* and *eximia.* Of these, *labrosa* is stated to have a porous front wall and a „triplet" of oral denticles. *Collaris* has neither pores nor denticles, *eximia* is provided with marginal pores.

On *Waldheimia* from the Jøkel Fiord, a form was found which, on account of its unusually elevated peristome, suggested *Phylactella.* On most of zooecia there was a single row of marginal pores, and it corresponded so far to *eximia* (fig. 28), but differed from it in having quite smooth oociea (fig. 29). Further, the peristome was elevated to the same height and thus was not provided with lateral, triangular lobes as is the case in *eximia.* The specimen from the Jøkel Fiord also had small avicularia with semicircular mandible (fig. 30). On young zooeciea the avicularia are quite plainly seen (fig. 29), but they are not so easily seen on older individuals which have the large collar below the oral aperture.

According to the diagnosis of the genus made by Hincks, there should be no avicularia, but as the resemblance between the species from the Jøkel Fiord and the hitherto described *Phylactella* species is striking in other respects, it is, I think, most practical to extend the limits of the genus to include also those species which have avicularia.

The oral denticle (fig. 31) is similar in shape to that of *Escharella labiata* (Pl. IV, fig. 31), but it is much narrower. Below the oral aperture, there is a swelling for the avicularian chamber, which is connected with the surface by help of a few pores (fig. 28).

Escharoides[1]) *jacksoni,* Waters.
Pl. III, fig. 19.

Mucronella coccinia, Bidenkap, Bryzoen von Ost-Spitzbergen. Zool. Jahrb. B. 10, p. 624, pl. 25, figs. 5, 6.
Smittia jacksoni, Waters, Bryozoa from Franz Josef Land. Linn. Soc. Journ. Zoology, vol. 28, p. 87, pl. 12, fig. 18.

[1]) Cf. Norman, Notes on the Nat. Hist. of East Finmark. Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 117.

The Jøkel Fiord III, 100 m., on *Terebratulina;* Kvænangen II, 90 m., on stone and *Waldheimia;* Ingøhavet, 300 m.

I consider that there are good grounds for distinguishing this form from *E. coccinea,* as Waters has done in the work above mentioned. The descriptions which Bidenkap and Waters have given of the *jacksoni* species, answer perfectly for the specimens I have found. In *jacksoni* the zooecia are much larger, the mandible too is rather different in shape (figs. 18, 19). It is new to the fauna of Norway.

Smittina[1]) *reticulata,* Macgillivray.

Reine, 100 m.; Mortsund III, 100 m.; Henningsvær I, 150 m. Lofoten is the hitherto known northern limit for this species.

Smittina trispinosa, Johnston.
(Pl. V, fig. 35).

Balstad (Lofoten).

Smittina arctica, Norman.

1869. *Escharella porifera,* forma *minuscula,* Smitt, Öfvers. Vet. Akad. Förh. 1867, Bihang, pp. 9, 73, pl. 24, figs. 33—35 (not forma *majuscula).*
1894. *Smittia arctica,* Norman (part.), A Month on the Trondhjem Fiord. Ann. Mag. Nat. Hist. ser. 6, vol. 13, p. 128.
1895. *Smittia arctica,* Nordgaard, System. fort. over Norges marine Polyzoa. Bergens Mus. Aarb., 1894—95, nr. 2, p. 27, pl. 1, fig. 2.
1900. *Smittia landsborovii,* var., Waters, Bryozoa from Franz Josef Land. Journ. Linn. Soc. Zool., vol. 28, pl. 12, fig. 7.
1903. *Smittia arctica,* Nordgaard. Die Bryozoen des westlichen Norwegens. Die Meeresfauna von Bergen, (ed. by. Dr. Appellöf) p. 90, pl. 1, figs. 16, 17.
1903. *Smittina arctica,* Norman, Notes on the Nat. Hist. of East Finmark. Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 121.

Moskenstrømmen, 90 m., on shells; The Østnes Fiord, 50—70 m., on stone; Malangen, 100—200 m.; Kvænangen II, 90 m.; Hammerfest (1894); Breisund, 100 m.; Sværholt (1894); The Kjølle Fiord (1894); Nordkyn (1894).

In the work above quoted, Norman has entered Smitt's forms of *Escharella porifera* (f. *minuscula* and *majuscula)* under the name of *Smittia arctica.* During my excursion to Finmark in 1894, I found numerous specimens of f. *minuscula,* of which I also found some in the Lyse Fiord (59° 3′ N.) in the winter of 1902. In the course of investigations made in 1899 in northern Norway, I found it at several places, and I also succeeded in one locality in obtaining forma *majuscula,* on a stone in the Porsanger Fiord, 200 m. A closer examination of the latter species has led to the conclusion that it must be considered to be a distinct one. It is doubtless most correct to retain Norman's designation, *arctica,* but this term will now have a different meaning to that originally given to it by Norman, as it will now only apply to forma *minuscula,* Smitt.

Smittina majuscula, n. sp.
Pl. IV, figs. 36—38.

1869. *Escharella porifera,* forma *majuscula,* Smitt. Öfvers. etc. 1867, Bihang, pp. 9, 74, pl. 24, figs. 36—38.
1888. *Smittia landsborovii,* forma *porifera,* Hincks. Ann. Mag. Nat. Hist., ser. 6, vol. 1, p. 225, pl. 14, fig. 2.

[1]) Cfr. Norman, (l. c. p. 120).

The Porsanger Fiord, 200 m., on a stone.

Smitt (l. c., p. 75) calls attention to the fact that the ectocyst in zooecia and ooecia are thinner than in the foregoing form.

In *arctica* there are in the ooecia often transverse and longitudinal lines or sutures, these too are mentioned by Smitt (l. c., p. 74, pl. 24, fig. 33). Smitt also says that these lines sometimes occur in the ooecia of *majuscula*, but I have not noticed them.

It is easy to distinguish between the two species. With regard to size, it may be mentioned that the zooezia in *arctica* are 0.8 mm. in length from the lower end to the tip of the oral denticle, and the corresponding measurement in *majuscula* gives 0.5—0.6 mm. Ooecia in *arctica* are rather oval, in *majuscula* they are approximately ballshaped, in both species they are punctured like a thimble, but this is coarser in *majuscula* than in the other species.

The perforation in the frontal wall of the zooecia of *majuscula* is closer than in *arctica*, where it is, indeed, somewhat different. Hincks (l. c., pl. 14, fig. 2) has illustrated the oral denticle as being pointed, and I found some of them of this shape in the colony which I had under examination.

Operculum in *arctica*, I have not yet succeeded in isolating, in *majuscula*, on the other hand, it has a characteristic form, which also differs from the usual one in the genus *Smittina* (fig. 37).

A very evident difference between to two species is that the zooecia in *majuscula* are plainly separated, while in *arctica* they more evenly merge into each other.

This species is most likely exclusively arctic. In addition to the Porsanger Fiord, in Finmark, the following findingplaces are mentioned, Spitzbergen, (Smitt), St. Lowrence (Hincks).

Smittina smitti, Kirchenpauer.
Pl. IV, fig. 24.

The Øgs Fiord I, 100 m.

In „Bryozoen des westlichen Norwegens“, I used a new name for this form, *Smittia levenseni*, as Kirchenpauer's name for Smitt's *Escharella legentilii*, forma *prototypa* had quite slipped out of my memory, notwithstanding that I made a note of it several years ago. Norman[1]) here too made the necessary correction. I beg reference to Norman's list of synonyms, at the same time remarking that *Schizoporella Harmsworthi*, Waters, ought to be excluded from it, in accordance with what I have previously pointed aut, that this must be = *Schizoporella reticulato-punctata*, Hincks.

Each zooecium has 6—8 lateral rosette-plates. As far as I could see, the two upper ones were bi-pored and the two next ones tri-pored.

This species has not previously been found in Norway.

Smittina jeffreysi, Norman.[2])

The Porsanger Fiord, 70 m.

The species was not previously found in Norway.

Rhamphostomella scabra, (Fabr.), Smitt.
(Pl. V, figs. 8—11).

1867. *Cellepora scabra*, Smitt (part.), Krit. förteckn., p. 30, pl. 28, figs. 183—185.

1886. *Rhamphostomella scabra*, Lorenz, Bryozoen von Jan Mayen, p. 93.

Digermulen, on stone, 150 m.; The Jøkel Fiord I, 100 m.; The Porsanger Fiord, 70 m.

Lorenz divided Smitt's *Cellepora scabra* into two species, and as for as I can judge this division is perfectly justifiable. The difference between them may be characterized as follows.

R. costata has an oral denticle (pl. V, fig. 22) but in *scabra* it is wanting. In *costata* the avicularian mandible is about half as long as it is wide, while in *scabra* the height is only very little more than the width.

The ooecia in *costata* have usually more pores than those of *scabra* have (cfr. figs. 9, 21). The rostrum in the latter species is shorter and blunter than in the former one. It is generally the case too that the radial lines in *costata* are continued on the rostrum, but this is not often so in the case of *scabra*. Both species are punctured on the basal wall of the zooecium (fig. 10) but more closely in *scabra* than in *costata*.

Bidenkap[1]) has found *Rh. scabra* in the Lyngen Fiord. So that the species is now known from the coast of Finmark to Lofoten.

Rhamphostomella costata, Lorenz.
(Pl. V, figs. 21, 22).

1867. *Cellepora scabra*, Smitt (part), Krit. förteckn., pag. 30, pl. 28, figs. 186—188.

1886. *Rhamphostomella costata*, Lorenz, Bryozoen von Jan Mayen, p. 12 (94), pl. 7, fig. 11.

1892. *Rhamphostomella costata*, Hincks, Polyzoa of St. Lawrence. Ann. and Mag. Nat. Hist., ser. 6, vol. 3, p. 426, pl. 21, figs. 6—8.

1900. *Rhamphostomella costata*, Waters, Bryozoa from Franz Josef Land, p. 91, pl. 11, figs. 26, 27.

Tromsø, Mehavn (1894).

Norman has taken this form in the Varanger Fiord, and Bidenkap in Lyngen. The hitherto known southern limit for this species is Tromsø.

Rhamphostomella plicata, Smitt.
(Pl. V, figs. 14, 15.)

1867. *Cellepora scabra*, forma *plicata*, Smitt, Krit. fört., p. 30, pl. 28, figs. 189, 191, 195.

1877. *Cellepora plicata*, Hincks, Polyzoa from Iceland and Labrador. Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 106, pl. 11, figs. 3, 4.

1886. *Rhamphostomella plicata*, Lorenz, Bryozoen von Jan Mayen, p. 12 (94).

1900. *Rhamphostomella plicata*, Waters, Bryozoa from F. J. L., p. 92, pl. 11, figs. 28, 29.

Nordkyn (1894), on an annelid tube.

As is the case with *costata*, this species too has an oral denticle, which is, however, longer and narrower than in the species mentioned.

The ooecium is as a rule provided with a few pores. I was not able to discover any punctures on the back side of the colony. It is therefore probable that Smitt's fig. 190 does not represent this species.

---

1) Finmark Polyzoa, p. 128.

2) Refer to synonyms in „Finmark Polyzoa“, p. 120.

1) Lyngenfjordens evertebral fauna. Tromsø Mus. Aarb. 20, 1897, p. 92.

Rhamphostomella radiatula, Hincks.
Pl. V, fig. 16, 17.

1867. *Cellepora scabra f. plicata,* Smitt (part.), Krit. fört. pl. 28, fig. 193.
1877. *Lepralia radiatula,* Hincks, Polyzoa from Iceland and Labrador. Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 104, pl. 10, figs. 9—14.
1886. *Rhamphostomella radiatula,* Lorenz, Bryozoen von Jan Mayen, p. 13 (95), pl. 7, fig. 9.

Hammerfest (1894); The Trold Fiord Sund, 40 m.; The North Cape (1894); The Kjølle Fiord (1894).

I found this species quite common on algae and hydroids which I took on the coast of Finmark in the autumn of 1894.

The zooecia are rather small, and the species is easily distinguished from the foregoing one, in that it wants the suboral rostrum and by the presence of the peculiar elevated peristome, about which Hincks (l. c., p. 104) very appropriately remarks that it has „a very fantastic appearance".

The species is now known from Labrador, Iceland, Spitzbergen, Jan Mayen and Finmark.

Rhamphostella contigua, Smitt.
Pl. V, figs. 18—20.

1867. *Cellepora ramulosa,* forma *contigua,* Smitt, Krit. fört. p. 31, 189, pl. 28, figs. 198—201.

The Østnes Fiord, 50—70 m., on stone; Hammerfest (1894), on stone; Breisund, 100 m., on a gastropod shell; Mehavn (1894), on *Balanus.*

The species of the genus *Cellepora* have characteristic opercula with a more or less distinct proximal lobe as in the *Schizoporella* species.

The shape of the operculum in the above mentioned species proves that it is quite impossible to look upon it as a variety of *C. ramulosa,* it can, indeed, not be considered to belong to the *Cellepora* genus. Neither is it a typical *Rhampostomella,* but I retain it for the present under that genus, as I do not now know any more suitable place for it.

The surface of the zooecia are quite even, occassionally there is a suggestion of radial stripes. The young zooecia have as a rule 4 spines on the distal side of the oral aperture. The operculum is more solid than in the other *Rhampostomella* species. The mandible of the avicularia is not of the same shape either as is characteristic of the other species which belong to the same genus.

Cellepora tuberosa, D'Orbigny.

1867. *Cellepora ramulosa,* f. *tuberosa,* Smitt., Krit. fört. pp. 31, 191.
1903. *Cellepora tuberosa,* Nordgaard. Die Bryozoen des westlichen Norwegens, p. 69, pl. 2, figs. 28—34.

Moskenstrømmen; The Østnes Fiord, 50—70 m.; The North Cape (1894).

Respecting this species, I beg to refer to what I have previously said in the paper written by me, which is quoted above.

Cellepora nodulosa, Lorenz.
Pl. III, figs. 21—24.

1867. *Cellepora ramulosa,* f. *avicularis,* Smitt (part.), Krit. förteckn., p. 32, 194, pl. 28, figs. 207—210.
1886. *Cellepora nodulosa,* Lorenz, Bryozoen von Jan Mayen p., 14 (96), pl. 7, fig. 14.

Kvænangen II, 90 m.; The Jøkel Fiord II, 80 m.; The Jøkel Fiord III, 100 m.; The North Cape (1894); The Porsanger Fiord; Sværholt (1894); The Kjølle Fiord (1894); Mehavn (1894).

The specimens from the places above mentioned answer, on the whole, well to Lorenz's illustrations and description of *C. nodulosa.*

The mandible of the avicularia (fig. 24) had a row of fine teeth in the distal margin, and in the operculum b was > h (fig. 23). On examining some old material of *Cellepora* specimens, I found that the forms which I entered as *C. pumicosa* from Finmark in my list of Norwegian Cheilostomata were really young colonies of *nodulosa.*

I am afraid that Norman and Waters have been guilty of the same mistake, when they mention *pumicosa* respectively from Finmark and Franz Josef Land. I do not think that *pumicosa* occurs in Finmark. In addition to the places already mentioned, I have determined specimens of *C. nodulosa* from the North Ocean Expedition st. 223, 273, 363.

Bidenkap has taken it in the inner part of the Lyngen Fiord.

Cellepora ventricosa, Lorenz.
Pl. III, figs. 26—29.

When I was working out the Bryozoa from the North Ocean Expedition, I treated *ventricosa* and *incrassata* as being the same, as I supposed that the difference between the forms lay within the limits of variation for the one species. After I had got more material, however, I found that they must be treated as two separate species, and this opinion is shared by Waters in his treatment of the Bryozoa from Franz Josef Land.

I have a typical *C. ventricosa* (fig. 26) from Breisund in Finmark.

The zoarium probably never attains to such a decided branching as is the case in *C. incrassata.* The two species can be distinguished at once by the naked eye, as *incrassata* is comparatively smooth on the surface, the zooecia not reaching so far forward from the colony as in *ventricosa.*

There were no vicarious avicularia on the specimens of *C. ventricosa* which Lorenz and Waters had at their disposal, but they were present (fig. 29) in my colony from Breisund. They are different from those in *C. incrassata,* the greatest width of the mandible of *ventricosa* is about double that at the hinging joint, while the corresponding mandible in *incrassata* is more evenly wide. (Cfr. Waters, Bryozoa, from F. J. Land, pl. 12, fig. 13).

The mandible in the oral avicularium is semicircular also in *ventricosa* (fig. 28), but it is considerably larger than in *incrassata.*

C. ventricosa is new to Norwegian fauna.

Cellepora incrassata, Smitt.
Pl. III, fig. 25.

Hammerfest (1894).

Waters has called attention to the fact that *Cellepora incrassata,* Lamarck and *C. incrassata,* Smitt are not identical. The former is found in the Mediterranean and is supposed to be the same as *C. coronopus,* S. Wood, while *C. incrassata,* Smitt has proved only to have arctic distribution. It occurred in the material which Mc Andrew collected in Finmark in 1856 and the species

is entered by BUSK under the name *Cellepora cervicornis.*[1]) WATERS does not, however, adopt this name, because a large number of forms have been given the name *Cellepora cervicornis* and *Eschara cervicornis.*

I believe I have identified the following *Cellepora* species on the Norwegian coast:— *pumicosa, ramulosa, tuberosa, dichotoma, avicularis, nodulosa, costazi, ventricosa* and *incrassata.*

Retepora beaniana, KING.

Røst III, 100 m.; Moskenstrømmen I, 200 m.; The Kirk Fiord III, 70—80 m.; Balstad; Mortsund III, 100 m.; Ure I, 200—250 m.; The Østnes Fiord, 130 m.; The Beier Fiord, 50—150 m.; Digermulen, 100—150 m.; Stønesbotn, 40—80 m.; Malangen, 100—200 m.; Hammerfest, Ingøhavet, 300 m.; Breisund, 100 m.; Mehavn (1894).

Retepora cellulosa, LIN.

Malangen, 100—200 m.; Hammerfest (1894); The North Cape (1894); The Porsanger Fiord, 200 m.; Sværholt (1894).

This species has not hitherto been found by me south of Malangen.

Retepora wallichiana, BUSK.
Pl. III, fig. 20.

The Beier Fiord, 50—150 m.; Balstad; Stønesbotn, 40—80 m.; Malangen, 100—200 m.; The North Cape (1894); Nordkyn (1894). I have also found this form in Radøsund, a little north of Bergen. The species is arctic in its distribution.

Cyclostomata.

Crisia eburnea, LIN.

Moskenstrømmen I, 200 m.; The Kirk Fiord IV, 30—50 m.

Crisia denticulata, LAMARCK.

The Kirk Fiord, 100 m.; Malangen, 380 m.

Tubulipora liliacea, PALLAS.
Pl. III, fig. 30.

The Sag Fiord, 200 m.; on dead branches of *Isidella hippuris;* Malangen, 100—200 m.

Tubulipora penicillata?, FABR.
Pl. III, fig. 31.

The North Cape (1894); Mehavn (1894).

Idmonea atlantica, FORBES.
Pl. III, fig 32.

The Sea N. W. of Røst, 700 m.; Moskenstrømmen I, 200 m.; The Kirk Fiord, 30—50 m.; The Beier Fiord, 50—150 m.; Reine, 100 m.; Balstad, 30—50 m.; Mortsund I, 200 m.; The Østnes Fiord, 130 m.; The Jøkel Fiord I, 100 m.; Breisund 100 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

Diastopora patina, LAMARCK.

Malangen, 100—200 m.

[1]) Ann. and Mag. Nat. Hist., ser. 2, vol. 18, p. 32, pl. 1, fig. 1.

Diastopora obelia, JOHNSTON.

Moskenstrømmen, 90 m., on *Waldheimia;* The Kirk Fiord III, 70—80 m.; Digermulen, on stone, 150 m.; The Tys Fiord I, on *Lophohelia,* 500 m.; Malangen, 100—200 m.; Ingøhavet, on sponges, 300 m.

Reticulipora intricaria, SMITT.

Sværholt (1894).

Hornera lichenoides, (PONTOP.), LIN.
Pl. III, fig. 33.

Røst II, 150 m.; Moskenstrømmen, 90 m.; Reine, 100 m.; Mortsund II, 100 m.; Stønesbotn, 40—80 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Mehavn (1894).

Hornera violacea, M. SARS.

Malangen, 100—200 m.; Malangen, 380 m.

Lichenopora hispida, FLEMING.

The Kirk Fiord, 100 m.; The Tys Fiord I, on *Lophohelia,* 500 m.; Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

Lichenopora verrucaria, FABRICIUS.

Grøtø, on algae, 6—24 m.

Domopora stellata, GOLDFUSS.
Pl. III, fig. 34.

Reine (Lofoten), 100 m.; Malangen, 100—200 m., Malangen indicates the northern limit of the species.

Defrancia lucernaria, M. SARS.

The Kirk Fiord, 50—80 m., both living and dead colonies; The Ogs Fiord I, 100 m. (dead colony); Kvænangen II, 90 m.; The Jøkel Fiord I, 100 m.; The Jøkel Fiord II, 80 m.; The Porsanger Fiord, 70 m.

Ctenostomata.

Alcyonidium gelatinosum, LIN.[1])

Malangen, 100—200 m.

Alcyonidium disciforme, SMITT.
Pl. III, fig. 35.

Lyngen III, 320 m.

This peculiar species had not previously been found on the Norwegian coast.

Flustrella hispida, FABRICIUS.

The North Cape (1894), on *Fucus serratus;* Nordkyn (1894), on *Fucus serratus.* NORMAN has found this species at Svolvær, Lofoten.

Flustrella corniculata, SMITT.
Pl. III, fig. 37, 38.

1871. *Alcyonidium corniculatum,* SMITT, Krit. förteckn. ets. Öfvers. Kgl. Vet. Akad. Forh. 1871, p. 1123, pl. 20, figs. 10—16.

[1]) *Alcyonidium hirsutum,* FLEM. has been found by NORMAN on *Fucus* at Svolvær, Lofoten.

1886. *Flustrella corniculata*, LORENZ, Bryozoen von Jan Mayen, p. 99.
1897. *Flustrella corniculata*, BIDENKAP, Bryozoen von Ost-Spitzbergen. Zool. Jahrb. B. 10, 1897, p. 634.
1900. *Flustrella corniculata*, BIDENKAP, Die Bryozoen von Spitzbergen und König Karls Land. Fauna arctica, Bd. I, p. 531.
1900. *Alcyonidium cervicornis*, ALICE ROBERTSON, Paper from the Harriman Alaska Expedition, Bryozoa. Proc. Wash. Acad. Science, vol. 2, p. 330, pl. 21, figs. 14—17.
1903. *Flustrella corniculata*. NORMAN, Notes on the Nat. Hist. of East Finmark. Ann. and Mag. Nat. Hist., ser. 7, vol. 11, p. 576.

Svolvær, Lofoten (1894), on algae.

NORMAN was the first to find this species on the Norwegian coast. He found it living between tidemarks at Vadsø. It is interesting that this form which had previously only been found in the arctic regions can exist as far down as Lofoten. SMITT has described the species from Spitzbergen, where it has later been taken by KÜKENTHAL and WALTER, as well as by RÖMER and SCHAUDINN. (Cf. BIDENKAP, l. c.).

Miss ROBERTSON has described a species from material from Alaska, under the name *Alcyonidium cervicornis*, which is probably the same as SMITT's species. The only thing which might suggest a difference, is that the aperture of the zooecium in *cervicornis* is mentioned as being circular, while in *corniculata* (as in *hispida*) it is a fissure which is provided with two lobes. In preserved material, however, these facts may easily be wrongly interpreted. The characteristic, branched spines (Pl. III, figs. 37, 38), which are situated one at each corner between the zooecia, from which they are separated by an intermediate wall, seem to be alike in the two forms. They appear really to be identical. Both in *hispida* and *corniculata*, there are two semicircular shaped thickened places near at the oral aperture, these probable serve the same purpose as the operculum in *Cheilostomata*.

Bowerbankia imbricata, ADAMS.
Pl. III, fig. 36.

Nordkyn (1894), on *Laminaria*.

I have a specimen from the North Ocean Expedition, st. 343, in which several colonies have grown together, forming comparatively thick branches (Pl. III, fig. 36).

The foregoing list of Bryozoa from the northern part of the Norwegian coast is not complete, but it is my opinion that it is fairly representative. The number has been increased by the addition of several species.

Of those forms described by SMITT from the numerous Swedish arctic expeditions, there are now only exceedingly few which have not been observed by me on our northern coast. The Bryozoan fauna from Lofoten to the Varanger Fiord proves to contain more arctic elements than was previously supposed.

Brachiopoda.

HERMAN FRIELE and J. SPARRE SCHNEIDER determ.
Remarks by the author.

Crania anomala, MÜLL.

The Kirk Fiord II, 70—80 m.; Mortsund (Vest Fiord), 200 m.; Digermulen, 100—150 m.; Hammerfest (1894).

G. O. SARS[1]) mentions The Komag Fiord in Vest Finmarken as the northern limit for this species. Hammerfest is a little further north.

Rhynchonella psittacea, CHEMN.

Malangen, 100—200 m.; Kvænangen II, 90 m.; The Jøkel Fiord III, 100 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

The southern limit for this species is The Malangen Fiord.

Terebratulina caput-serpentis, LIN.[2])

The Beier Fiord, 50—150 m.; The Tys Fiord, 500 m.; The Kirk Fiord II, 70—80 m.; Mortsund II (Vest Fiord), 200 m.; The Øgs Fiord I, 100 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m., Kvænangen II, 90 m.; The Jøkel Fiord III, 100 m.; Hammerfest (1894); Ingøhavet, 300 m.; The Porsanger Fiord, 200 m.; The Kjølle Fiord (1894).

Terebratulina septentrionalis, COUTH.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Salten Fiord II, 320—380 m.; Balstad (Vest Fiord), 150 m.

Waldheimia cranium, MÜLL.

The Skjerstad Fiord III, 230 m.; The Tys Fiord, 500 m.; Røst II, 150 m.; Moskenstrømmen, 90 m.; Reine (Vest Fiord), 100 m.; The Kirk Fiord IV, 30—50 m.; Balstad (Vest Fiord), Mortsund II, 200 m.; Stene (Vest Fiord), 100 m.; The Østnes Fiord; Digermulen, 100—150 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Hammerfest (1894); Ingøhavet, 300 m.; The Kjølle Fiord (1894).

Pelecypoda.

HERMAN FRIELE and J. SPARRE SCHNEIDER determ.
Remarks by the author.

Anomia ephippium, LIN.

Balstad, 80 m.; Digermulen, 100—150 m.; Malangen, 100—200 m.; Kvænangen, 90 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

Anomia aculeata, MÜLLER.

The Skjerstad Fiord III, 230 m.; The Sag Fiord, 200 m.; The Kirk Fiord, 70 m.; Stønnesbotn, 40—80 m.; Malangen, 100—200 m.; The Jøkel Fiord, 100 m.

Pecten islandicus, MÜLLER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord X (Misvær Fiord), 10—30 m.; Moskenstrømmen, 90 m.; The Østnes Fiord; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.; The Porsanger Fiord, 50 m.

The largest specimen from The Skjerstad Fiord X was 86 mm. in height and 84 mm. in length.

Pecten aratus, GMELIN.

Moskenstrømmen, 90 m.; Balstad (Vest Fiord), 150 m.

---

[1]) Mollusca Regionis Arcticæ Norvegiæ, p. 8.

[2]) Some of the places here mentioned doubtless have reference to *T. septentrionalis*, SCHNEIDER having considered it to be a variety of *caput-serpentis* but FRIELE has treated it as a separate species.

The specimen from Moskenstrømmen was 15 mm. in height and 14 mm. in length.

The northern limit for this species is Lofoten.

Pecten septemradiatus, Müller.

The Beier Fiord, 50—150 m.; (1 spec., 11 mm.); The Sag Fiord, 200 m. (s)[1]); Malangen, 100—200 m. (s); Gaukværø, 250 m.

The largest specimen from Gaukværø was 32 mm.

At Tromsø, Schneider only found shells, but both M. and G. O. Sars collected the species in the Varanger Fiord.

Pecten tigrinus, Müller.

The Østnes Fiord.

This species was previously known right up to The North Cape. Norman in 1890 took it in The Lang Fiord (South Varanger)[2]).

Pecten striatus, Müller.

Stønnesbotn, 40—80 m.

Havøsund (Finmark) is the northern limit for this species.

Pecten incomparabilis, Risso.

The Østnes Fiord, 30 m.

Lofoten is the northern limit for the species.

Pecten imbrifer, Lovén.

Malangen, 380 m.; Kvænangen II, 90 m.

Pecten vitreus, Chemnitz.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Tys Fiord, 500 m. (in quantities on *Lophohelia prolifera);* The Øgs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.

Pecten abyssorum, Lovén.

The Skjerstad Fiord IV, 330 m.; Brettesnes—Skroven, 350—400 m.; Malangen, 380 m.

Pecten similis, Laskey.

Moskenstrømmen I, 200 m.; Balstad (Lofoten), 150 m.

Pecten groenlandicus, Sowerby.

Lyngen II, 250 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.

The southern limit for the species is Tromsø.

At St. Lyngen II several specimens were taken, the largest measured 22 mm., thus being very nearly as large as the specimens from Spitzbergen which are given as being 24 mm.

Lima excavata, Fabr.

Arnø, 300—400 m.; Tys Fiord I, 500 m.

The largest specimen measured 135 mm.

G. O. Sars has caught this species at Skroven (Lofoten). According to Sars[3]) the species is mentioned from Finmark by Mr. Andrew, but is has, however, not been taken there later.

Friele and Grieg[4]) give the distribution of this species to the depths between The Hebrides end The Faroe Isles, Portugal, The Azores and Senegambia. On our coast the species is limited to the great fiord depths with their particularly constant temperature and salinity (6—7° C., about 35 ‰).

As The Vest Fiord is the most northern of the principal fiords where these physical conditions prevail, I am inclined to think that the mention of this species from Finmark must be a mistake.

The northern limit should be looked upon as Lofoten, until there is definite information that it is distributed still further northwards.

Lima loscombi, Sowerby.

Moskenstrømmen, 90 m.

G. O. Sars has found shells of this species at Skroven. My catches in Moskenstrømmen prove that the species still exists at Lofoten, which must therefore be considered to be its northern limit on our coast.

Limatula crassa, Forbes.

Moskenstrømmen I, 200 m.

Mytilus edulis, Lin.

Nordkyn (1894). Common other places too.

Modiola modiolus, Lin.

The Skjerstad Fiord X, 10—50 m.; Hammerfest (1894); Troldfiordsund, 40 m.; Nordkyn (1894).

Modiola phaseolina, Philippi.

Moskenstrømmen, 200 m.; Reine I, 150 m.; Balstad, Stene, 120—200 m.; Henningsvær-Strømmen, 20—40 m.; The Sag Fiord, 200 m.; Malangen, 100—200 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Dacrydium vitreum, Møller.

Ure I (Vest Fiord), 200—250 m.; mouth of Raftsund, 250—300 m.; The Øgs Fiord I, 100 m.; Malangen, 380 m.; Lyngen II, 250 m.

Crenella decussata, Mont.

The Skjerstad Fiord II, 100—185 m.; Gaukværø II, 25 m.; Hammerfest (s).

Modiolaria laevigata, Gray.

The Beier Fiord, 50—150 m.; The Østnes Fiord, 20 m.; Breisund, 100 m.; The North Cape (1894).

The Beier Fiord is the southern limit for this species. I collected a small specimen here.

Modiolaria nigra, Gray.

The Beier Fiord, 50—150 m.; The Kirk Fiord II, 50 m.; Mortsund III, 100 m.; Gaukværø, 250 m.; Stønnesbotn, 40—80 m.; The Jøkel Fiord I, 100 m.; Troldfiordsund, 40 m.

Nucula tumidula, Malm.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; The Salten Fiord II, 320—380 m.; Brettesnes—Skroven, 350—400 m.; Tranødybet, 607—640 m.

Nucula tenuis, Mont.

The Skjerstad Fiord VII, 490 m.; The Øgs Fiord I, 100 m. (s); The Jøkel Fiord, 100 m.

1) (s) means that only empty shells were found.

2) Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist. ser. 7, vol. X, p. 357.

3) Mollusca Regionis arcticæ Norvegiæ, p. 24.

4) Mollusca III, p. 6. The Norw. North Atl. Exp.

Leda pernula, Müller.

The Skjerstad Fiord III, 230 m.; The Kirk Fiord II, 50 m.; Svolvær, 150 m.; The Østnes Fiord, 30—40 m.; mouth of Raftsund, 250—300 m.; The Øgs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Gaukværø II, 250 m.; Malangen, 380 m.; Stønnesbotn, 40—80 m.; Kvænangen II, 90 m.; The Porsanger Fiord, 200 m.

Leda minuta, O. F. Müller.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; Kvænangen II, 90 m.; Digermulen, 100—150 m.

Portlandia lucida, Lovén.

The Skjerstad Fiord II, 100—185 m.; The Skjerstad Fiord VII, 490 m.; Øxsund, 600 m.; The Kirk Fiord II, 50 m.; Mortsund I, 200 m.; Ure I (Vest Fiord), 200—250 m.; Risværflaket, 150—180 m.; mouth of Raftsund, 250—300 m.; Malangen, 380 m.

Portlandia intermedia, M. Sars.

The Porsanger Fiord, 200 m.

This species was first caught by M. Sars in The Varanger Fiord. The Norw. North Atl. Exp. caught it at St. 260 (The Porsanger Fiord), 261, (The Tana Fiord) and 262 (off The Varanger Fiord). Hitherto it has not been taken further westwards and southwards on the Norwegian coast than The Porsanger Fiord.

Portlandia tenuis, Phillippi.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord VI, 125 m.; The Skjerstad Fiord VII, 490 m.

Portlandia lenticula, Møller.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord, 100—185 m.; The Skjerstad Fiord VI, 125 m.; The Kirk Fiord IV, 70—80 m.; Mortsund I, 200 m.; The Øgs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Malangen, 380 m.; Stønnesbotn, 40—80 m.; The Jøkel Fiord II, 80 m.

Portlandia frigida, Torell.

Risværflaket, 150—180 m.

Yoldia limatula, Say.

The Kirk Fiord, 70—80 m.; Svolvær, 150 m.; The Østnes Fiord, 30—40 m. (several specimens, the largest being 36 mm.); Stønnesbotn, 40—80 m.; The Kjølle Fiord (1894).

The southern limit for the species is Lofoten.

Malletia obtusa, M. Sars.

Moskenstrømmen I, 200 m.; Brettesnes—Skroven, 300—400 m.; Tranødybet, 640 m.

The northern limit for this species is Lofoten.

Arca pectunculoides, Scacchi.

The Beier Fiord, 50—150 m.; (var. *septentrionalis*); The Skjerstad Fiord III, 230 m.; (var. *septentrionalis*); The Skjerstad Fiord VI, 125 m. (var. *septentrionalis*, the largest specimen 9.5 mm.); The Øxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrømmen, 200 m.; Ure I, 200—250 m.; Mortsund I, 200 m.; Brettesnes—Skroven, 300—400 m.; The Øgs Fiord I, 100 m.; mouth of Raftsund, 250—300 m.; Tranødybet, 640 m.; Gaukværø II, 250 m.; Malangen, 100—200 m. (var. *septentrionalis*); Malangen, 380 m.; The Jøkel Fiord III, 100 m.; (var. *septentrionalis*); Kvænangen, 300—343 m. (var. *septentrionalis*).

The typical form extends to Malangen, or, at any rate, to Lofoten; var. *septentrionalis* is limited southwards in the Beier Fiord.

Arca glacialis, Gray.

The Porsanger Fiord, 200 m.

According to G. O. Sars, this species has been caught at Magerø by Verkrüzen. Further westwards and southwards this species has not hitherto been noticed on our coast.

Limopsis minuta, Phil.

The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; Landego, 200—450 m.; Øxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrømmen, 200 m.; Balstad, 150 m.; Stene (Vest Fiord), 120—200 m.; Ure I, 200—250 m.; Skroven, 200—400 m.; The Kanstad Fiord, 30—90 m.

Friele and Grieg mentioned that this species was taken by The Norw. North Atl. Exp. at St. 290, which is situated about half way between Norway and Beeren Eiland, which is the most northern place where it is known.

Cardium nodosum, Turt.

The Kanstad Fiord, 30—90 m.

Cardium echinatum, Lin.

The Salten Fiord I, 15—20 m.

Cardium fasciatum, Mont.

The Beier Fiord, 50—150 m. (s); She Skjerstad Fiord IX, 80 m.; The Salten Fiord I, 15—20 m.; The Kirk Fiord II, 50 m.; Napstrømmen, 40 m.; Henningsværstrømmen, 40 m.; The Østnes Fiord; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m.; Troldfiordsund, 40 m.

Cardium minimum, Phil.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Salten Fiord II, 320—380 m.; Moskenstrømmen, 200 m.; Ure I, 200—250 m.; Mortsund, 200 m.; The Kanstad Fiord, 30—90 m.; Gaukværø II, 250 m.; Malangen, 380 m.; Lyngen III, 300 m.

Cyprina islandica, Lin.

The Salten Fiord I, 15—20 m.; Napstrømmen, 40 m.; Stene (Vest Fiord), 120—200 m.; The Østnes Fiord, 40 m.; The Øgs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Troldfiordsund, 40 m.; The Kjølle Fiord (1894).

Astarte borealis, Chemn.

Troldfiordsund, 40 m.

Astarte banksi, Leach.
(*A. compressa*, Mont.).

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord I, 30—50 m.; The Østnes Fiord, 30 m.; Stønnesbotn, 40—80 m.; Hammerfest.

Astarte sulcata, da Costa.

The Beier Fiord, 50—150 m.; The Salten Fiord II, 320—380 m.; Røst II, 150 m.; Reine I, 150 m.; Balstad, 150 m.; Mortsund III, 100 m.; Ure I, 200—250 m.; Svolvær, 150 m.; Digermulen, 150 m.; Malangen, 100—200 m.; The Kjølle Fiord (1894).

Astarte compressa, LIN.
(*A. elleptica*, BROWN).

The Beier Fiord, 50 m.; The Østnes Fiord, 30 m.

Astarte crenata, GRAY.
(*A. crebricostata*, FORBES).

The Skjerstad Fiord II, 185 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord VI, 125 m.; Røst II, 150 m.; The Kirk Fiord, 70—100 m.; Mortsund I, 200 m.; Stene (Vest Fiord), 120—200 m.; Risværflaket, 180 m.; The Øgs Fiord I, 100 m., Malangen, 100—200 m.; Lyngen II, 250 m.; Kvænangen, 300—343 m.; Kvænangen, 90 m.; The Jøkel Fiord II, 60 m.; The Porsanger Fiord, 200 m.; The Kjølle Fiord (1894).

The specimens from The Kirk Fiord showed no signs of deformity. The largest were 34 mm. in length and 80 mm. in height. This species has not been observed on our coast further south than The Skjerstad Fiord.

Venus gallina, LIN.

The Salten Fiord I, 15—20 m.; The Salten Fiord II, 320—380 m.

Several shells were found on the beach at Værø on 12/3 1896.

Venus ovata, PENNANT.

Røst II, 150 m.; Mortsund III, 100 m.; Svolvær; Malangen, 100—200 m.; Sværholt (1894).

Lucina borealis, LIN.

Napstrømmen, 30—40 m. (s); Svolvær (1894).

Shells belonging to this species were found on the beach at Værø the 12/3 1896.

Axinus flexuosus, MONT.

The Skjerstad Fiord II, 185 m.; Landego, 200—450 m.; The Kirk Fiord, 40—100 m.; Risvær, 150 m.; Malangen, 380 m.

Axinus sarsi, PHIL.

Risværflaket, 150—180 m. (s).

Axinus croulinensis, JEFF.

The Skjerstad Fiord IV, 330 m. (s); The Skjerstad Fiord VII, 490 m.

Kelliella miliaris, PHIL.

Mouth of Raftsund, 280—300 m.

This form has not been caught alive on the Norwegian coast north of Raftsund. According to SCHNEIDER[1]) shells have been found at Tromsø by Dr. KRAUSE.

Montacuta substriata, MONT.

GRIEG[2]) mentions that this species has been found on several specimens of *Spatangus purpureus*.

Mactra elliptica, BROWN.

Røst I, 120 m.; Stene (Vest Fiord), 120—200 m.; Henningsværstrømmen, 20—40 m.; Troldfiordsund, 40 m.; The North Cape (1894).

[1]) Tromsøsundets Molluskfauna. Tromsø Mus. Aarsh. VIII, p. 85.

[2]) Oversigt over det nordlige Norges echinodermer, p. 33. Berg. Mus. Aarb. 1902. No. 1.

Syndosmya alba, WOOD.

The Salten Fiord I, 15—20 m.

Syndosmya longicallis, SCACCHI.

The Salten Fiord II, 320—380 m. (s); The Folden Fiord, 530 m.; Landego, 200—450 m.; Mortsund I, 200 m.; Skroven, 200—400 m.

Syndosmya nitida, MÜLLER.

Mortsund I, 200 m.; Tranødybet, 640 m.; Gaukværø II, 250 m.; Malangen, 380 m.

Tellina (Macoma) calcaria, CHEMN.

Kvænangen II, 90 m. (s).

Solen pellucidus, PENN.

The Salten Fiord I, 15—20 m.

The northern limit for this species is Lofoten.

Neæra arctica, M. SARS.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m

FRIELE and GRIEG[1]) mention that this species was only known from one place on the Norwegian coast, viz. Vadsø (Varanger Fiord).

Neæra obesa, LOV.

The Beier Fiord, 50—150 m.; The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; Oxsund, 600 m.; The Kirk Fiord IV, 30—50 m.; Mortsund I, 200 m.; Brettesnes—Skroven, 350—400 m.; Risværflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; Tranødybet, 640 m.; Gaukværø II, 250 m.; Malangen, 380 m.; Lyngen III, 300 m.

Neæra obesa var. *glacialis*, G. O. SARS.

The Beier Fiord, 50—150 m.

In my collection there were most likely several forms of this variety which have been classified under the chief form. (*N. obesa*, LOV.).

Neæra subtorta, G. O. SARS.

The Skjerstad Fiord VI, 125 m.; The Jøkel Fiord, 100 m.

The Skjerstad Fiord is the southern limit for this species, as far as is now known.

Neæra rostrata, SPENGEL.

The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; Landego, 200—400 m.; Brettesnes—Skroven, 350—400 m.

This is one of the southern forms, which G. O. SARS has found at Hasvik on Sørø.

Neæra cuspidata, OLIVI.

The Skjerstad Fiord VI, 125 m.

Poromya granulata, NYST.

Malangen, 100—200 m.

Corbula gibba, OLIVI.

The Østnes Fiord, 20 m.

[1]) Mollusca III, p. 39.

Saxicava arctica, LIN.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord IV, 330 m.; The Sag Fiord, 200 m.; Balstad, 150 m.; Ure I, 200—250 m.; Svolvær (1894); Digermulen, 100—150 m.; The Øgs Fiord I, 100 m.; Malangen, 100—200 m.; The North Cape (1894); The Kjølle Fiord (1894).

Zirphæa crispata, LIN.

On the farm Sund in The Beier Fiord, on the beach.

This is one of the mussels which are used as bait.

Scaphopoda.

HERMAN FRIELE ane I. SPARRE SCHNEIDER determ.

Remarks by the author.

Dentalium entale, LIN.

The Skjerstad Fiord IX, 80 m.; Røst II, 150 m.; Svolvær (1894); Digermulen, 100—150 m.; Sværholt (1894).

Dentalium occidentale, STIMPSON.

The Kirk Fiord II, 70—80 m.; Brettesnes—Skroven, 350—400 m.; Malangen, 100—200 m.; Lyngen III, 300 m.

Dentalium agile, M. SARS.

Landego, 200—400 m.; The Folden Fiord, 530 m.

Lofoten is the northern limit for this species.

Siphonodentalium vitreum, M. SARS.

The Skjerstad Fiord II, 185 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; Malangen, 380 m.; Lyngen II, 250 m.; Lyngen III, 300 m.; Kvænangen II, 90 m.; Kvænangen, 300—348 m.; The Jøkel Fiord I, 100 m.; The Jøkel Fiord II, 60 m.; The Porsanger Fiord, 200 m.

This arctic form has not hitherto been noticed south of The Skjerstad Fiord.

Siphonodentalium quinquangulare, FORBES.

The Sag Fiord, 200 m.; Øxsund, 600 m.; Mortsund I, (Vest Fiord), 200 m.; Brettesnes—Skroven, 350—400 m.

Placophora.

HERMAN FRIELE and I. SPARRE SCHNEIDER determ.

Remarks by the author.

Hanleyia hanleyi, BEAN.

The Kirk Fiord II, 50 m.; Malangen, 100—200 m.

Leptochiton cancellatus, SOWERBY.

The Sag Fiord, 200 m.; Kvænangen II, 90 m.

Leptochiton cinereus, LIN.

Henningsværstrømmen, 20—40 m.; The Østnes Fiord, 30 m., Digermulen, 100—150 m.

Trachydermon exaratus, G. O. SARS.

The Salten Fiord II, 320—380 m.

Trachydermon albus, LIN.

„Glea" (Røst); Digermulen, 100—150 m.

Trachydermon ruber, LOWE.

Troldfiordsund, 40 m.

Tonicella marmorea, FABR.

The Kirk Fiord IV, 30—50 m.; Henningsværstrømmen, 30—40 m.; The Østnes Fiord I, 30 m.

Gastropoda.

HERMAN FRIELE and I. SPARRE SCHNEIDER determ.

Remarks by the author.

Patella vulgata, LIN.

Several large shells belonging to this species were found on the beach at Værø (12/3 1896).

This species is found as far north as Raftsund (Lofoten) on the inner coast, according to G. O. SARS. Along the outer coast, SCHNEIDER[1]) mentions that it is found up to the 70th degree of latitude (Vandø, NW of Tromsø).

Patina pellucida, LIN.

Svolvær harbour; Sværholt (1894).

SCHNEIDER mentions that the species may be found right up to Vardø.

Acmæa testudinalis, MÜLL.

„Glea" (Røst); The Kjølle Fiord (1894); Sværholt (1894).

Tectura rubella, FABR.

In a bottom sample from Hammerfest (s). The southern limit for the species is Tromsø.

Tectura virginea, MÜLL.

Henningsværstrømmen, 20—40 m.; The Skjerstad Fiord II, 30—50 m.

Tectura fulva, O. F. MÜLL.

Skroven, 200—400 m.

Lepeta coeca, O. F. MÜLL.

The Skjerstad Fiord IX, 30—50 m.; The Øgs Fiord I, 100 m.; The Jøkel Fiord I, 100 m.; The Porsanger Fiord.

Puncturella noachina, LIN.

The Skjerstad Fiord IX, 80 m.; The Folden Fiord, 530 m.; Røst II, 100 m.; Mortsund III, 100 m.; in a sample of bottom from Hammerfest (s).

Emarginula fissura, LIN.

The Østnes Fiord, 20 m.

G. O. SARS mentions Hammerfest as the northern limit for the species.

Scissurella crispata, FLEM.

Mortsund I, 200 m.

Margarita helicina, FABR.

„Glea" (Røst), Øxsund, 600 m.; Kvænangen, 300—343 m.; Troldfiordsund, 40 m.; Repvaag (Porsanger Fiord), 10 m.

[1]) Tromsøsundets Molluskfauna, p. 101.

Margarita groenlandica, CHEMN.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; Balstad; Henningsværstrømmen, 20—40 m.; Svolvær, Risværflaket, 150—180 m.; The Østnes Fiord; Stønnesbotn, 40—80 m.; The Jøkel Fiord, 100 m.; Hammerfest; Troldfiordsund, 40 m.; The Kjølle Fiord (1894).

Margarita cinerea, COUTH.

The Kirk Fiord IV, 30—50 m. (s); The Jøkel Fiord III, 100 m.; Hammerfest (1894) (s).

Machæroplax obscura, COUTH.

The Beier Fiord, 50—150 m. (s); Stønnesbotn, 40—80 m.; Kvænangen II, 90 m. (s); Troldfiordsund, 40 m.; Hammerfest (1894) (s).

Gibbula cineraria, LIN.

The Salten Fiord I, 15—20 m.; The Salten Fiord II, 320—380 m; The Kirk Fiord III, 70—80 m.;. Balstad, 10—35 m.; Svolvær (1894); Risværflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; Lyngen III, 300 m.

Gibbula tumida, MONT.

The Salten Fiord I, 15—20 m.; Henningsværstrømmen, 20—40 m.; The Kanstad Fiord, 30—90 m.; Kvænangen II, 90 m.

Trochus occidentalis, MIGH.

The Beier Fiord, 50—150 m.; Reine, 100 m.; Balstad, 10—35 m.; Malangen, 100—200 m.; The Jøkel Fiord I, 100 m.; Hammerfest (1894) (s); Breisund, 100 m.; Ingøhavet, 300 m.

Conulus millegranus, PHIL.

Digermulen, 100—150 m.
The northern limit for this species is Digermulen.

Capulus hungaricus, LIN.

Røst II, 150 m.
I collected two dwarf-like specimens at Røst, which is the most northernly place where the species has been observed alive. The Norw. North Atl. Exp. only found shells at stations 192 and 195.

Velutina lævigata, PENN.

Svolvær (1894); Breisund, 100 m.

Velutina flexilis, MONT.

Breisund, 100 m.

Lamellaria latens, O. F. MÜLL.

Arnø, 300—400 m.
A gigant specimen, about 50 mm.

Marsenia prodita, O. F. MÜLL.

Mortsund III, 100 m.; Sværholt (1894).

Onchidiopsis glacialis, M. SARS.

Tys Fiord, 500 m.

Amauropsis islandica, GMELIN.

The Beier Fiord, 50—150 m. (s); Malangen, 100—200 m. (s); Hammerfest (s); Troldfiordsund; Breisund.

Natica (Lunatia) montagui, FABR.

The Kirk Fiord III, 70—80 m.; Balstad, 10—35 m.; Mortsund I, 100 m.; The Østnes Fiord; Digermulen, 100—150 m.; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m.; Troldfiordsund, 40 m.

Natica (Lunatia) intermedia, PHIL.

The Salten Fiord I, 15—20 m.
Lofoten is the northern limit for this species.

Natica (Lunatia) groenlandica, BECK.

The Salten Fiord I, 15—20 m.; The Kirk Fiord II, 50 m.; The Kirk Fiord III, 70—80 m.; The Kirk Fiord IV, 30—50 m.; Mortsund III, 100 m.; Digermulen, 100—150 m. (s); The Øgs Fiord I, 100 m.; Stønnesbotn, 40—80 m.; Lyngen II, 250 m. (s); The Porsanger Fiord, 200 m. (s).

Natica (Lunatia) affinis, GMEL.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Salten Fiord, 320—380 m.; Øxsund, 600 m.; Ure I, 200—250 m.; Østnes Fiord (s); Gaukværø, 250 m.; Malangen, 100—200 m. (s); Kvænangen II, 90 m. (s); The Jøkel Fiord I, 100 m.; The Jøkel Fiord III, 100 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

Trichotropis borealis, BROD. & SOW.

Moskenstrømmen I, 200 m.; Balstad, 10—35 m.; Malangen, 100—200 m.; The Jøkel Fiord I, 100 m.; The Jøkel Fiord II, 80 m.; Hammerfest (s); Troldfiordsund, 40 m.; The Porsanger Fiord. 200 m.

Trichotropis conica, MØLL.

The Jøkel Fiord.
Tromsø is the southern limit for this species.

Littorina littorea, LIN.

„Glea“ (Røst), several large specimens.

Littorina rudis, METON.

The Skjerstad Fiord IX, 80 m.; Risværflaket, 150—180 m. (s).

Var. *groenlandica*, MØLL. collected at Vardø was given me by my friend OLAF VAADE.

Littorina palliata, SAY.

From OLAF VAADE, factory-manager, I got specimens of this species, which were collected at Vardø.

Littorina obtussata, LIN.

„Glea“ (Røst); Risværflaket, 150—180 m. (s).

Lacuna divaricata, FABR.

The Salten Fiord I, 15—20 m.; Balstad, 10—35 m.; Henningsværstrømmen, 20—40 m.; Svolvær (1894); Risværflaket, 150—180 m.; The Kanstad Fiord. 30—90 m.; Kvænangen II, 90 m.; Troldfiordsund, 40 m.; The North Cape (1894); Sværholt (1894).

Rissoa (Alvania) jeffreysi, WALLER.

The Skjerstad Fiord VI, 125 m.; Hammerfest (s).

Rissoa (Onoba) aculeus, GOULD.

Hammerfest (s).

Lovenella metula, Lov.

The Kirk Fiord II, 50 m.; Brettesnes—Skroven, 300—400 m.

Cerithiopsis costulata, Møll.

Hammerfest (s).

Læocochlis granosa, Wood.

Reine I, 150 m.

Aporhais pes-pelicani, Lin.

The Salten Fiord I, 15—20 m. Several rather large specimens. G. O. Sars has occasionally caught this species in Lofoten, and M. Sars[1]) mentions that he found a specimens in the Øx Fiord. On the inner coast, from Lofoten to the Øx Fiord, the species has not been noticed; but on the outer coast it is mentioned by Schneider as being collected at Lyngø and Vandø.

Scalaria groenlandica, Chemn.

The Skjerstad Fiord III, 230 m. (s); Lyngen III, 300 m.; Hammerfest (s); Troldfiordsund, 40 m.; The Porsanger Fiord, 200 m. At Hammerfest and at the station Lyngen III empty shells of var. *loveni* were found.

Scalaria obtusicostata, Wood.

Lyngen III, 300 m. (s).

Hemiaclis ventrosa, Jeffreys.

The Sag Fiord, 200 m.

Eulimella scillæ, Scacchi.

The Folden Fiord, 530 m.

Eulima intermedia, Cantr.

The mouth of Raftsund, 280—300 m.; Øxsund, 600 m.

Eulima stenostoma, Jeffr.

Landego, 200—400 m.; Mortsund I (Vest Fiord), 200 m.; the mouth of Raftsund, 250—300 m.; The Sag Fiord, 200 m.

According to Schneider the former northern limit for this species was Tromsø; but The Norw. North Atl. Exp. collected specimens not only in The Skjerstad Fiord, but also in The Vest Fiord, The Alten Fiord, The Porsanger Fiord and The Tana Fiord.

Admete viridula, Fabr.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Skjerstad Fiord IX (s); Moskenstrømmen, 200 m.; Balstad, 150 m.; Mortsund II, 200 m. (s); Stene (Vest Fiord), 100—200 m.; Gaukværø II, 250 m.; Lyngen II, 250 m.; The Jøkel Fiord, 100 m.; The Porsanger Fiord, 200 m.

Mangilia (Raphitoma) anceps, Eichw.

Moskenstrømmen I, 200 m.

This is one of the southern forms which has been caught by G. O. Sars at Hasvik on Sørø.

Taranis cirrata, Brugnone.

Lyngen II, 250 m.

Bela pyramidalis, Strøm.

Kvænangen II, 90 m.

[1]) Beretning om en zoologisk Reise Sommeren 1849. Sep. p. 64.

Bela sarsi, Verrill.

The Kirk Fiord IV, 30—50 m.; The Porsanger Fiord, 70 m.

Bela declivis, Lov.

The Beier Fiord, 50—150 m. (s); The Jøkel Fiord, 100 m. (s).

Bela nobilis, Møller.

The Jøkel Fiord I, 100 m.

Bela scalaris, Møller.

Gaukværø II, 250 m. (s); Malangen, 100—200 m. (s); Lyngen III, 300 m. (s).

Bela rugulata, Møller.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 185 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.

Bela exarata, Møller.

Lyngen II, 250 m.; Kvænangen, 300—343 m. (s).

Bela harpularia, Couth.

The Salten Fiord I, 15—20 m.; Stønnesbotn, 40—80 m. (var. *rosea*).

Bela trevelyana, Turt.

The Skjerstad Fiord VI, 125 m.

Bela tenuicostata, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; Mortsund I, 200 m.; Gaukværø II, 250 m.

Typhlomangilia nivalis, Lov.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Sag Fiord, 200 m.; Mortsund II, 200 m.; Ure I, 200—250 m.; Digermulen, 100—150 m.; Gaukværø II, 250 m.; Malangen, 100—200 m.; Lyngen III, 300 m.

Spirotropis carinata, Phil.

Moskenstrømmen, 200 m.; Balstad, 150 m.; Digermulen, 100—150 m. (s); The Sag Fiord, 200 m.; Gaukværø II, 250 m.; Malangen, 380 m.

Metzgeria alba, Jeffreys.

Moskenstrømmen, 200 m.; Ure I, 200—250 m. (s); Malangen, 100—200 m.

Trophon truncatus, Strøm.

Henningsværstrømmen, 20—40 m.; Hammerfest (s).

Trophon clathratus, Lin.

The Beier Fiord, 50—150 m. (var. *gunneri*); Moskenstrømmen, 200 m.; The Kirk Fiord II, 70—80 m. (s); The Kirk Fiord III; Svolvær (1894) (var. *gunneri*); Breisund, 100 m. (the typical form and var. *gunneri*); The Porsanger Fiord, 200 m.

Trophon barvicensis, Johnst.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; Moskenstrømmen, 200 m. (s); Malangen, 380 m. (s).

Purpura lapillus, Lin.

The Salten Fiord I, 15—20 m.; „Glea" (Røst), on the beach; The North Cape (1894); Nordkyn (1894).

Astyris rosacea, GOULD.

„Glea" (Røst), on the beach; Hammerfest (s); Breisund, 100 m. (s).

Nassa incrassata, STRØM.

Svolvær (1894).

Buccinum undatum, LIN.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord I, 30—50 m.; The Skjerstad Fiord IX, 50 m. „Glea" (Røst); The Østnes Fiord, 40 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m.

Buccinum groenlandicum, CHEMN.

The Jøkel Fiord II, 60 m.
Tromsø is its southern limit.

Buccinum finmarchianum, VERKR.

Kvænangen II, 90 m. (s); Breisund, 100 m.; The Porsanger Fiord, 200 m.; Sværholt (1894).
There is no certain proof that this species has been seen alive south of the Bals Fiord, where, according to SCHNEIDER, it has been caught on a fishing line.

Ukko turtoni, BEAN.

The Porsanger Fiord, 200 m.

Volutopsis norvegica, CHEMN.

Reine (Vest Fiord), 100 m.; Balstad II, 80 m.; The Østnes Fiord; The Kanstad Fiord (s).
The southern limit, as known at present, for this species is The Vest Fiord.

Neptunea despecta, LIN.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.

Sipho islandicus, CHEMN.

Røst I, 100 m.

Sipho gracilis, var. *glaber*, VERKRÜZEN.

Reine, 100 m.; Balstad; The Østnes Fiord; Malangen, 100—200 m.; Sværholt (1894); Mehavn (1894).

Sipho turritus, M. SARS.

Reine, 100 m.; Balstad, 150 m. (s); Mortsund, 200 m. (s); Svolvær (1894).

Sipho ebur, MØRCH.

The Skjerstad Fiord II, 185 m. (s); The Folden Fiord, 530 m.; Arnø, 300—400 m. (s); Malangen, 100—200 m.

Sipho latericeus, MØLLER.

The Jøkel Fiord III, 100 m. (s); Breisund, 100 m.; The Porsanger Fiord, 200 m. (s).
The southern limit is Tromsø.

Cylichna alba, BROWN.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; Mortsund I, 200 m.; The Østnes Fiord; The Porsanger Fiord, 200 m.

Amphisphyra expansa, JEFFR.

The Folden Fiord, 530 m.

Amphisphyra hiemalis, COUTH.

The Beier Fiord, 50—150 m.; Risvær, 150—180 m.

Scaphander puncto-striatus, MIGH.

The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; The Kirk Fiord III, 70—80 m.; Svolvær (1894); The Kanstad Fiord, 30—90 m.; Malangen, 380 m.; The Jøkel Fiord III, 100 m.

Scaphander lignarius, LIN.

Balstad, 150 m.; Mortsund III, 100 m.
The northern limit is Lofoten. In the neighbourhood of Bergen (Herlø Fiord) the species reaches a length of 40 mm., the largest specimen from Mortsund measured 19 mm.

Philine quadrata, WOOD.

The Skjerstad Fiord VII, 490 m.; Reine I, 150 m.

Philine finmarchica, M. SARS.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.
The Skjerstad Fiord is the southern limit for this species, as far as is now known.

Pleurobranchus plumula, MONT.

The Tys Fiord, 500 m.; Breisund, 100 m.
GRIEG[1]) mentions it from the Vaags Fiord (Nord Fiord) and STORM[2]) from Rødberg in the Trondhjem Fiord.
The northern limit must now be changed to the Breisund.

Nudibranchiata.[3])

Remarks by HERMAN FRIELE, who has also determ.

Calidna obvelata, O. G. Müller.
C. repanda, A. & H. (?).

Kvænangen, 90 m.
A small specimen. The teeth correspond to *C. obvelata*, but in external appearance, there seems to be some difference; I do not, however, venture to name a new species after my examination of a specimen which was possibly only imperfectly developed, and was also greatly contracted.

Dendronotus arborescens, MÜLLER.

Røst II, 150 m.; The Porsanger Fiord, 200 m.

Dendronotus robustus, VERRILL.

The Skjerstad Fiord II, 100—185 m.; The Skjerstad Fiord IV, 330 m.; Stønesbotn, 40—80 m.; The Jøkel Fiord, 80 m.

Campespe major, BERGH.

The Skjerstad Fiord III, 230 m.

[1]) Skrabninger i Vaagsfjorden og Ulvesund, Ytre Nordfjord. Berg. Mus. Aarb. 1897. no. XVI, pag. 23.
[2]) Oversigt over Trondhjemsfjordens fauna, p. 13. Meddelelser fra stationsanlæggets arbeidskomite for Trondhjems biologiske station. Trondhjem 1901.
[3]) Descriptions by Mr. FRIELE of the new species here mentioned will soon be published.

Only one specimen of this species, which is described by RUD. BERGH in „Nudibranchien“ from the Wilhelm Barents Expedition, has previously been found, and that was at Vardø.

Coryphella rufibranchialis, JOHNST.

The Skjerstad Fiord, 130 m.; Grøtø, 6—24 m.; Repvaag, 10 m.

Coryphella robusta, n. sp., M. S.

$^{25}/_{4}$ 1899, Breisund, 100 m. Two specimens.

Coryphella nordgaardi, n. sp., M. S.

The Skjerstad Fiord II, 100—185 m. Four specimens.

Coryphella sp.?

The Skjerstad Fiord IV, 330 m. One specimen.

Judging from the structure of the teeth and the edges of the jaws, it would seen that this specimen belongs to an unknown species; but it was in such a mutilated condition that its external appearance cannot be described.

Aeolida pusilla, n. sp. M. S.

Kvænangen, 90 m.

Cephalopoda.

Ommatostrephes todarus, RAF.

Jaws of this species were found in the stomachs of cods and coal fish *(Gadus virens)* at Sunderø (in Vesteraalen) in February 1897.

Rossia glaucopis, LOV.

Mortsund I, 200 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Sværholt (1894).

Crustacea.

Copepoda.

The author determ.

Euryte longicauda, PHILIPPI.

(Thorellia brunnea, BOECK).[1]

Repvaag (Porsanger Fiord), 10 m.

The species was very common at this place, the females generally had ovisacks.

Dactylopus strömi, BAIRD.

Repvaag (Porsanger Fiord), 10 m.

Thalestris (Dactylopus) gibba, KRØYER. (G. O. SARS determ.).

Repvaag (Porsanger Fiord), 10 m.

Harpacticus chelifer, MÜLLER.

Repvaag (The Porsanger Fiord), 10 m.

Idya furcata, BAIRD.

Repvaag (The Porsanger Fiord), 10 m.

[1]) Cf. GIESBRECHT, Mittheilungen über Copepoden. Mittheilungen aus der zool. Station zu Neapel. 14 Vol. Nr. 1, 1900, p. 57.

Important constributions to the knowledge of the Copepoda of northern Norway have recently been made by Prof. G. O. SARS,[1]) Dr. THOMAS SCOTT[2]) and the Rev. Canon A. M. NORMAN. Dr. SCOTT has described several new species from Finmark.

Branchiopoda.

Nebalia bipes, FABR.

Repvaag (Porsanger Fiord), 10 m.

A detailed description of *Nebalia* is given by G. O. SARS in *Fauna Norvegiæ*, Vol. 1. *(Phyllocarida* and *Phyllopoda)*.

Ostracoda.

G. O. SARS determ.

Paradoxostoma variabile, BAIRD.

Repvaag (Porsanger Fiord), 10 m.

Cypridina norvegica, BAIRD.

Øxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrømmen, 180 m.; Reine (Vest Fiord), from the stomach of cod; Høla (Vest Fiord) 250 m.; Gaukværø II, 250 m.

I also found this species in the stomach of cod *(Gadus callarias)* caught at Christiansund $^{20}/_{2}$ 1896 and at Sartorø $^{23}/_{2}$ 1898.

Contributions to a knowledge of the *Ostracoda* of Northern Norway have especially been made by A. M. NORMAN[3]) and G. O. SARS.[4])

Cirripedia.

The author determ.

Lepas anatifera, LIN.

Moskenesø (Lofoten), on a glass ball.

Conchoderma auritum, LIN.

Mehavn (Finmark) on *Megaptera boops* fastened to *Coronula diadema*.

Scalpellum stroemi, M. SARS.[5])

Tranødybet, 607—640 m.; The Porsanger Fiord, 200 m.

Balanus balanoides, LIN.

Common on the rocks along the beach.

Balanus crenatus, BRUG.

The North Cape (1894). Is found in tolerably deep water.

Balanus porcatus, da COSTA.

Kvænangen II, 90 m.; The North Cape (1894).

[1]) Crustacea of Norway, Vol. IV.

[2]) Notes on some Copepoda from Arctic Seas collected in 1890 by the Rev. Canon A. M. NORMAN, F. R. S. By THOMAS SCOTT, F. L. S. Ann. Mag. Nat. Hist. Ser. 7. Vol. XI.

[3]) Notes on the Marine *Crustracea Ostracoda* of Norway. Ann. Mag. Nat. Hist. Ser. 6, Vol. VII, 1891, p. 108.

[4]) Oversigt af Norges marine Ostracoder. Kristiania. Vid. Selsk. Forh. 1865.

[5]) G. O. SARS determ.

Balanus hameri, ASCANIUS.

Røst I, 120 m.

The specimen was about 50 mm. in length. G. O. SARS has collected some specimens, in the Sorøsund near Hammerfest, which were 90 mm. in length and 50 mm. in height.

Several (possibly all) of the specimens collected at Røst contained a very large number of nauplius larvæ (24/3 1899).

Verruca stroemia, MÜLL.

Common in all fiords.

Coronula diadema, LIN.

Mehavn (Finmark) on the skin of *Megaptera boops*. According to WELTENER,[1]) this species is a thorough cosmopolitan.

Amphipoda.

J. SPARRE-SCHNEIDER determ.
Remarks by the author.

Socarnes vahli, KRØYER.

Troldfiordsund, 40 m.; Breisund, 100 m.

Ambasia danielsseni, BOECK.

The Skjerstad Fiord III, 230 m.; Uro I (Vest Fiord), 200—250 m.

Aristias tumidus, KRØYER.

Reine (Vest Fiord), 150 m., *juniores*.

Calisoma hopei, A. COSTA.[2])

Calisoma crenata, G. O. SARS, *Amphipoda*, p. 53, Pl. XIX. Fig. 1.

The Skjerstad Fiord IX, 80 m.

Hippomedon denticulatus, BATE.

The Salten Fiord I, 15—20 m.; Napstrømmen (Lofoten) 30—40 m.

Hippomedon propinquus, G. O. SARS.

Kvænangen II, 90 m.

Orchomene serratus, BOECK.

Henningsvær I (Vest Fiord), 150 m.; The Tys Fiord I, 500 m.

Orchomene amblyops, G. O. SARS.

Mortsund I (Vest Fiord), 200 m.

Orchomenella minuta, KRØYER.

Troldfiordsund, 40 m.; Repvaag (Porsanger Fiord), 10 m.

Orchomenella pinguis, BOECK.

Repvaag (Porsanger Fiord), 10 m.

Tryphosella[3]) *höringi*, BOECK.

The Skjerstad Fiord II, 100—185 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; Mortsund (Vest Fiord), 200 m.; Uro I (Vest Fiord), 200—250 m.; Malangen, 380 m.

[1]) Die Cirripedien der Arktis. Fauna arctica von RÖMER und SCHAUDINN. Vol. I, p. 302.

[2]) Cf. NORMAN, British Amphipoda. Ann. Mag. Nat. Hist. Ser. 7, Vol. V, p. 200.

[3]) Cf. NORMAN. On British Amphipoda, p. 205.

SCHNEIDER has used the names of SARS in „*Amphipoda*". I have made some alterations in this respect, as I have acted upon NORMAN's remarks in his revision of British Amphipoda.

Uristes umbonatus, G. O. SARS.
Pseudotryphosa umbonata, G. O. SARS.

Reine (Vest Fiord) from the stomach of cod.

Anonyx nugax, PHIPPS.

The Salten Fiord I, 15—20 m.; The Kirk Fiord II; The Kanstad Fiord, 30—90 m.; The Jøkel Fiord, from the stomach of cod; Repvaag (Porsanger Fiord), 10 m.

Haplonyx cicada, FABR.

Reine (Vest Fiord), from the stomach of cod; Svolvær (Vest Fiord), from the stomach of cod; The Jøkel Fiord II.

Chironesimus debruyni, HOEK.

Kvænangen II, 90 m.

This species is previously known from The Barents Sea (HOEK); Lofoten, The Trondhjem Fiord, Christiansund (G. O. SARS).

Lepidepecreum umbo, GOES.

The Beier Fiord, 50—150 m.; Høla (Vest Fiord), 150 m.; Stønnesbotn, 40—80 m.; The Jøkel Fiord II, 80 m.

Leptophoxus falcatus, G. O. SARS.

Malangen, 380 m.

This species was previously known from Bohuslen and up to the coast of Nordland. The northern limit must now be taken to be Malangen.

Paraphoxus oculatus, G. O. SARS.

The Skjerstad Fiord VII, 490 m.

Ampelisca macrocephala, LILLJEBORG.

Kvænangen II, 90 m.

Ampelisca eschrichti, KRØYER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Kirk Fiord, 50 m.; The Øgs Fiord, 100 m.; The Kanstad Fiord, 30—90 m.

Ampelisca æquicornis, BRUZELIUS.

Malangen, 100—200 m.; Kvænangen II, 90 m. The previously known northern limit was Lofoten; this must now be changed to Kvænangen.

Ampelisca amblyops, G. O. SARS.

Malangen, 380 m.

This species was previously known from Bohuslen, and SARS has collected it in the Kristiania Fiord and the Trondhjem Fiord. Its northern limit must now be taken to be Malangen.

Haplops tubicola, LILLJEBORG.

The Kirk Fiord II, 50 m.; Malangen, 380 m.

Stegocephalus inflatus, KRØYER.

Røst, from the stomach of cod; Malangen, 380 m.; Ingøhavet, 300 m.; The Porsanger Fiord, 200 m.

Stegocephalus similis, G. O. Sars.

The Skjerstad Fiord VII, 490 m.; Henningsvær (Vest Fiord), from the stomach of cod; Malangen, 380 m.

The most northerly place at which Sars has collected this species is Tjøtø. Its northern limit must now be changed to Malangen.

Andania abyssi, Boeck.

Malangen, 380 m.

The northern limit must now be moved from Lofoten to Malangen.

Amphilochus tenuimanus, Boeck.

Malangen, 380 m.

Sars has caught this species at different places on the west coast right up to Selsøvik, which is a little north of the arctic circle. Its northern limit will now be Malangen.

Metopa alderi, Bate.

The Skjerstad Fiord XVI; The Tys Fiord, 500 m.

Leucothoe spinicarpa, Abildgaard.

Henningsvær I, 150 m.; Tranødybet, 530 m.; Malangen, 380 m.

Sars has found this form at different places on the south and west coasts of Norway as far up as the Trondhjem Fiord. Its northern limit will now be Malangen.

Oediceros saginatus, Krøyer.

Troldfiordsund, 40 m. Occurred in very large numbers and with young.

Paroediceros lynceus, M. Sars.

The Kanstad Fiord, 30—90 m.; Stønnesbotn, 40—80 m. The southern limit for the species on our coast is, according to Sars, Appelvær.

Paroediceros propinquus, Goes.

The Beier Fiord, 50—150 m.; Lyngen II, 250 m.

Monoculodes subnudus, Norman.
(*Monoculodes falcatus*, G. O. Sars).

The Kirk Fiord III, 70—80 m.; Ure I (Vest Fiord).

Halimedon mülleri, Boeck.

Mortsund I (Vest Fiord), 200 m.; Gaukværø II, 250 m.

Halimedon acutifrons, G. O. Sars.

Mortsund I, (Vest Fiord), 200 m.; Gaukværø II, 250 m.

Halimedon megalops, G. O. Sars.

Repvaag (Porsanger Fiord), 10 m.

Halimedon brevicalcar, Goes.

Malangen, 380 m.

Bathymedon longimanus, Boeck.

(Vest Fiord), 150—180 m.

Aceros phyllonyx, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Salten Fiord, 200 m.; The Folden Fiord, 530 m.; Landego, 200—450 m.; The Kirk Fiord IV, 50 m.; Mortsund I, 200 m.; The Øgs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Gaukværø II, 250 m.; Stønnesbotn, 40—80 m.; The Jøkel Fiord I, 100 m.

Pleustes panoplus, Krøyer.

Røsthavet, 700 m.; Repvaag (Porsanger Fiord), 10 m.

Paramphitoe pulchella, Krøyer.

The Skjerstad Fiord XVI, on Hydroida.

Paramphitoe bicuspis, Krøyer.

Troldfiordsund, 40 m.

Paramphitoe assimilis, G. O. Sars.

Malangen, 380 m.

Parapleustes latipes, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Kanstad Fiord, 30—90 m.

Epimeria cornigera, Fabr.

The Sag Fiord, 200 m.

The northern limit is thus changed from the Trondhjem Fiord to the Sag Fiord.

Epimeria parasitica, M. Sars.

Balstad (Vest Fiord), 150 m.

As far as I know, this form has not previously been observed so far north as in Lofoten.

Epimeria tuberculata, G. O. Sars.

Malangen, 380 m.

This species was not previously found north of the Trondhjem Fiord.

Epimeria loricata, G. O. Sars.

Malangen, 100—200 m.; Lyngen II, 250 m.; Sars has collected this form at Hasvig, West Finmark. Malangen is the southern limit for the species.

Acanthozone cuspidata, Lepechin.

The Øgs Fiord, 100 m.

The southern limit for this arctic form is the Trondhjem Fiord.

Acanthonotosoma serratum, Fabr.

The Beier Fiord, 50—150 m.; Grøtø, 0—24 m.; The Kanstad Fiord, 30—90 m.; Stønnesbotn, 40—80 m.; Kvænangen, 340 m.; Troldfiordsund, 40 m.

Iphimedia obesa, Rathke.

Balstad (Vest Fiord).

Syrhoe crenulata, Goes.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 100—185 m., The Skjerstad Fiord III, 330 m

Pardalisca cuspidata, Krøyer.

The Jøkel Fiord, in the stomach of cod.

Pardalisca abyssi, Boeck.

Ingøhavet, 300 m.

Eusirus minutus, G. O. Sars.

Malangen, 380 m.

This species had previously only been found by Sars at Rødberg in the Trondhjem Fiord.

Rhacotropis aculeata, Lepechin.

Ingøhavet, 300 m.; The Porsanger Fiord, 70 m.

Rhacotropis helleri, Boeck.

The Skjerstad Fiord II, 100—185 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; Malangen, 380 m.; Lyngen II, 250 m.; Kvænangen, 300—343 m.

Rhacotropis macropus, G. O. Sars.

The Salten Fiord II, about 200 m.; The Skjerstad Fiord IV, 330 m.; Øxsund, 600 m.; Mortsund (Vest Fiord), 200 m.; Tranødybet, 607—640 m.

Haliragoides inermis, G. O. Sars.

Mortsund I (Vest Fiord), 200 m.; The Sag Fiord, 200 m.

Halirages fulvocinctus, M. Sars.

The Skjerstad Fiord IV, 330 m.; Brettesnes—Skroven, 350—400 m.; Risværflaket, 150—180 m.; The Sag Fiord, 200 m.; Kvænangen, 300—343 m.

Apherusa tridentata, Bruzelius.

Troldfiordsund, 40 m.

Calliopius læviusculus, Krøyer.

Repvaag (Porsanger Fiord), 10 m.

Paratylus swammerdami, H. Milne-Edwards.

Troldfiordsund, 40 m.

Melphidippa borealis, Boeck.

Malangen, 380 m.

Amathilla homari, Fabr.

Balstad (1897); The North Cape (1894); Sværholt (1894).

Gammarus locusta, Lin.

Røst II, 150 m.; Balstad, 30—40 m.; Reine, from the stomach of cod.

Melita dentata, Krøyer.

The Skjerstad Fiord IV, 330 m.; Troldfiordsund, 40 m.; The Jøkel Fiord II, 80 m.

Lilljeborgia pallida, Bate.

Ure I (Vest Fiord); Malangen, 380 m.

Lilljeborgia fissicornis, M. Sars

The Sag Fiord, 200 m.; Malangen, 380 m.; Lyngen III, 300 m.

Idunella æquicornis, G. O. Sars.

Kvænangen, 300—343 m.

This species has on the coast of Norway previously only been collected in the Varanger Fiord (Norman, G. O. Sars). The occurrence in Kvænangen is thus very interesting.

Gammaropsis erythrophthalma, Lilljeborg.

Røsthavet, 700 m.

This form had not previously been collected so far north as the Trondhjem Fiord. It was therefore remarkable to find it on the 68th degree of latitude.

Amphithoe rubricata, Mont.

Balstad (1897); Henningsværstrømmen (Vest Fiord), 20—40 m.; Grøtø, 0—24 m.

Ischyrocerus anguipes, Krøyer.

Røsthavet, 700 m.; Ingøhavet, 300 m.; Repvaag (Porsanger Fiord), 10 m.

Ischyrocerus minutus, Lilljeborg.

The Skjerstad Fiord XVI.

Erichtonius abditus, Templeton.

Ingøhavet, 300 m.

This species is, according to Sars „not unfrequently off the south and west coast of Norway". Its northern limit will now be the sea off Ingø.

Unciola leucopis, Krøyer.

Røsthavet, 700 m.

On the coast of Norway, this form had, hitherto, only been observed in the Varanger Fiord.

Ægiuella spinosa, Boeck.

The Skjerstad Fiord XVI; Malangen, 380 m.; Ingøhavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 70 m.

Caprella septentrionalis, Krøyer.

Breisund, 100 m.; The North Cape (1894).

Caprella monocera, G. O. Sars.

The North Cape (1894).

Paracyamus boopis, Lütken.

On *Megaptera boops* at Mehavn.

Literature concerning the *Amphipoda* of Northern Norway:

A. M. Norman, Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist., ser. 7, Vol. X, p. 479—483.

J. Sparre-Schneider, Undersøgelser af dyrlivet i de arktiske fjorde. Tromsø mus. aarsh. 14.

G. O. Sars, Crustacea of Norway, Vol. I.

It is worth noticing that the majority of the Amphipoda mentioned in the foregoing list were caught in the winter. In the list

only the localities and depths are given, but the dates of catch may be found in the list of dredging stations.

Isopoda.

J. Sparre Schneider determ.

Apseudes spinosus, M. Sars.

Gaukværø; Ure I (Vest Fiord), 200—250 m.

Æga psora, Lin.

Balstad, 150 m.; Mortsund (Vest Fiord); Skroven (Vest Fiord), 200—400 m.

Æga ventrosa, M. Sars.

Ingøhavet, 300 m.; two specimens, one of them with ova.

Idothea baltica, Pallas.

Høla (Vest Fiord), from the stomach of cod; Stønnesbotn, 40—80 m.; Kvænangen, 300—343 m.

Idothea emarginata, Fabr.

Stene in Bø, several specimens from the stomachs of cods; Troldfiordsund, 40 m.

Astacilla longicornis, Sowb.

Røsthavet, 700 m.

Janira maculosa, Leach.

The Tys Fiord I, 500 m.; Malangen, 380 m.

Munna fabricii, Krøyer.[1])

Repvaag (Porsanger Fiord), 10 m.

Munnopsis typica, M. Sars.

Several places in the Skjerstad Fiord; The Folden Fiord, 530 m.; Landego, 200—450 m.; Malangen, 380 m.; Lyngen II, 250 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.

Eurycope cornuta, G. O. Sars.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Malangen, 380 m.; Lyngen II, 250 m.; Kvænangen, 300—343 m.

Concerning the Isopoda of northern Norway, reference should be made to Norman[2]) and G. O. Sars.[3])

Cumacea.

G. O. Sars determ.

Lamprops fasciata, G. O. Sars.

Repvaag (Porsanger Fiord), 10 m.

Leucon nasicus, Krøyer.

Malangen, 380 m.

[1]) G. O. Sars determ.

[2]) Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist. ser. 7, vol. X, p. 478.

[3]) Crustacea of Norway, vol. II.

Eudorella emarginata, Krøyer.

The Jøkel Fiord, 80 m.

Diastylis rathkei, Krøyer.

Several places in the Skjerstad Fiord; Moskenstrømmen, 200 m.; The Kirk Fiord (several places); Ure I, 200—250 m.; Mortsund I, 200 m.; Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

Diastylis goodsiri, Bell.

Malangen, 100—200 m.; Lyngen II, 250 m.; The Jøkel Fiord I, 100 m.

It has never previously been noticed so far south as Malangen. It was, however, known from Kvænangen (*Aurivillius*, Schneider), the Porsanger Fiord (G. O. Sars) and from the Varanger Fiord (M. Sars).

Campylaspis rubicunda, Lilljeborg.

Mortsund I (Vest Fiord), 200 m.

Literature:—G. O. Sars, Crustacea of Norway, Vol. III.

A. M. Norman, Notes on the Nat. Hist. of East Finmark. Ann. Mag. Nat. Hist. Ser. 7, Vol. X, p. 478.

Carl Zimmer, Die arktischen Cumaceen. Fauna arctica, Bd. I.

Schizopoda.

The author determ.

Boreomysis tridens, G. O. Sars.[1])

The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; Øxsund, 600 m.; Tranødybet, 640 m.; Malangen, 380 m.

Norman[2]) has caught this form in the Trondhjem Fiord, and G. O. Sars[3]) in the Vest Fiord.

Malangen is thus the most northerly place at which this species is found.

Erythrops goësi, G. O. Sars.

The Skjerstad Fiord IV, 330 m.; The Jøkel Fiord I, 100 m.

Erythrops serrata, G. O. Sars.

Mortsund I (Vest Fiord), 200 m.; Ure I (Vest Fiord), 200—250 m.

Erythrops abyssorum, G. O. Sars.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; Mortsund I, 200 m.

Pseudomma roseum, G. O. Sars.

Malangen, 380 m.

Pseudomma truncatum, E. J. Smith.

Lyngen II, 250 m.

G. O. Sars has caught it in the Bugø Fiord, a branch of the Varanger Fiord.

The southern limit for the species will now be the Lyngen Fiord.

[1]) *Boreomysis arctica* and *Hemimysis abyssicola* are included among the plankton forms.

[2]) A Month on the Trondhjem Fiord. Ann. Mag. Nat. Hist. Ser. 6, Vol. XIII, p. 274.

[3]) Monographie over Norges Mysider, h. III, p. 17.

Parerythrops obesa, G. O. SARS.

The Sag Fiord, 200 m.; Mortsund I, 200 m.

Amblyops abbreviata, G. O. SARS.

The Skjerstad Fiord VII, 490 m.

Mysidopsis didelphys, NORMAN.

Reine I (Vest Fiord), 150 m.

Mysideis insignis, G. O. SARS.

The Skjerstad Fiord, 330 m.; Ure I, 200—250 m.; the mouth of Raftsund, 250—300 m.; Malangen, 380 m.

Mysis mixta, LILLJEBORG.

The Beier Fiord, 50—150 m.; The Jøkel Fiord II, 80 m.; Stønnesbotn, 40—80 m.

Macromysis inermis, RATHKE.

Balstad (Vest Fiord).

Decapoda.

The author determ.[1])

Pasiphæa tarda, KRØYER.[2])

Landego, 200—450 m.; Øxsund, 600 m.; Malangen, 380 m. A female from Malangen (14/4 1899) was carrying eggs without ocular spots.

Pandalus annulicornis, LEACH.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord I, 30—50 m.; Røst II, 150 m.; Moskenstrømmen, 200 m.; Balstad, 30 m.; Henningsværstrømmen, 20—40 m.; the mouth of the Raftsund, 250—300 m.; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m.; Kvænangen, 300—343 m.; Breisund, 100 m.; Mehavn (1894).

Females bearing eggs with ocular spots were observed on

14/4 1899, Malangen,
15/4 — , Stønnesbotn,
21/3 1900, the Beier Fiord.

Pandalus borealis, KRØYER.

The Beier Fiord, 50—150 m.; Landego, 200—450 m.; The Salten Fiord II, 200 m.; The Skjerstad Fiord II, 100—185 m.; Balstad, 150 m.; The Østnes Fiord, 100 m.; the mouth of the Raftsund, 250—300 m.; The Kanstad Fiord, 30—90 m.; Lyngen III, 300 m.; The Porsanger Fiord, 200 m.

Females bearing eggs with ocular spots were observed on

5/4 1900, Salten Fiord II, 200 m.

Pandalus propinqvus, G. O. SARS.

Balstad, 150 m.; Arnø, 300—400 m.; The Salten Fiord II, 320—380 m.; The Tys Fiord I, 500 m.; Malangen, 100—200 m.

Females bearing eggs with ocular spots occurred on

14/4 1899, Malangen, 100—200 m.

This species hat not previously been noticed north of Lofoten. Malangen must now be looked upon as its northern limit.

Pandalus platyceros, BRANDT.
(= *P. leptorrhyncus*, KINAHAN).

The Salten Fiord II, 320—380 m.

[1]) In doubtful cases Prof. G. O. SARS has identified.

[2]) This species is also included in the plankton forms, vide present work, p. 87.

Pandalus brevirostris, RATHKE.

The Beier Fiord, 50—150 m.; The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Balstad, 150 m.; Mortsund I, 100 m.; Ure I, 200—250 m.; Henningsvær I, 150 m.; Skroven, 200—400 m.; The Østnes Fiord, 100 m.; the mouth of the Raftsund, 250—300 m.; Gaukværø II, 250 m.; Malangen, 380 m.

Females bearing eggs, without ocular spots, occurred on

23/3 1900, The Østnes Fiord, 100 m.;
26/3 1900, Balstad, 150 m.;
31/3 1900, The Beier Fiord, 50—100 m.;
5/4 1900, The Salten Fiord II, 320—380 m.

The species is new in Malangen, which must now be considered as its northern limit on our coast.

Caridion gordoni, BATE.

Stene (Vest Fiord), 120—200 m.; Henningsvær, 150 m.

G. O. SARS[1]) says that the species is found right up to the Varanger Fiord.

Sclerocrangon boreas, PHIPPS.

The Skjerstad Fiord XVI; The Skjerstad Fiord IX, 30—40 m.; Grøtø, 6—24 m.; The Kanstad Fiord, 30—40 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Females bearing eggs with ocular spots occurred on 3/4 1900, the Skjerstad Fiord IX, 30—40 m. The Skjerstad Fiord is, as far as is known at present, the southern limit for this species, but it is probable that its distribution extends further south.

Crangon crangon, LIN.

Females bearing eggs, without ocular spots, occurred on

7/4 1900, Grøtø, 6—24 m.

Crangon almani, KINAHAN.

The Beier Fiord, 50—150 m.; Røst II, 150 m.; Svolvær, (1894); The Østnes Fiord; The Kanstad Fiord, 30—90 m.; Stønesbotn, 40—80 m.; Mehavn (1894).

Females bearing eggs, without ocular spots, occurred on

31/3 1900, the Beier Fiord, 50—150 m.

Pontophilus echinulatus, M. SARS.

Mortsund, 100 m. (2 specimens, about 12 mm. in length); Balstad, 150 m. (1 Female bearing eggs without ocular spots).

Pontophilus norvegicus, M. SARS.

The Beier Fiord, 50—150 m.; Arnø, 300—400 m.; Landego, 200—450 m.; The Salten Fiord II, 320—380 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; Øxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrømmen, 200 m.; Balstad, 150 m.; Mortsund I, 200 m.; Brettesnes-Skroven, 350—400 m.; the mouth of the Raftsund, 250—300 m.; Tranødybet, 607—640 m.; Gaukværø II, 250 m.; Malangen, 380 m.; Lyngen III, 300 m.

Females bearing eggs occurred, without ocular spots, on

22/2 1899, Mortsund I, 200 m.;
5/4 1900, The Salten Fiord, 320—380 m.;
17/2 1899, The Sag Fiord, 200 m.,

with ocular spots, on

16/3 1900, Balstad, 150 m.;
5/4 1900, The Salten Fiord, 320—380 m.

[1]) Crustacea II, p. 11. The Norw. North. Atl. Exp.

Sabinea septemcarinata, SABINE.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Skjerstad Fiord II, 100—185 m.; The Kirk Fiord II, 50 m.; The Østnes Fiord, 130 m.; Stønesbotn, 40—80 m.; Lyngen II, 250 m.; The Jøkel Fiord I, 100 m.; The Jøkel Fiord III, 100 m.; The Porsanger Fiord, 200 m.; The Kjølle Fiord (1894); Mehavn (1894).

Females bearing eggs with ocular spots occurred on

$^{21}/_4$ 1899, The Jøkel Fiord, 100 m.;
$^{27}/_4$ 1899, The Porsanger Fiord, 200 m.;
$^{2}/_4$ 1900, The Skjerstad Fiord, 30—50 m.

var. *sarsi*, SMITH.

The Beier Fiord, 50—150 m.; Balstad, 150 m.; Stene (Vest Fiord), 120—200 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.

Females bearing eggs with ocular spots occurred on

$^{14}/_4$ 1899, Malangen, 100—200 m.

Hippolyte gaimardi, M. EDW.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord IX, 30—50 m.; Grøtø, 6—24 m.; Napstrømmen (1896), 30—40 m.; The Ostnes Fiord I, 30 m.; Risværflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; The Jøkel Fiord I, 100 m.; Troldfiordsund, 40 m.; The Porsanger Fiord, 200 m.

Females bearing eggs with ocular spots occurred on

$^{10}/_3$ 1899, Risværflaket, 150—180 m.;
$^{17}/_3$ —, Kanstad Fiord, 30—90 m.;
$^{20}/_4$ —, Jøkel Fiord I, 100 m.;
$^{25}/_4$ —, Troldfiordsund, 40 m.;
$^{22}/_3$ 1900, The Ostnes Fiord I, 30 m.;
$^{3}/_4$ —, The Skjerstad Fiord IX, 30—50 m.;
$^{5}/_4$ —, The Salten Fiord I, 15—20 m.;
$^{7}/_4$ —, Grøtø, 6—24 m.

Hippolyte pusiola, KRØYER.

The Salten Fiord I, 15—20 m.; Balstad (1896), 30 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Females bearing eggs, without ocular spots, occurred on

$^{25}/_4$ 1899, the Breisund, 100 m.

Hippolyte turgida, KRØYER.

The Østnes Fiord, 30 m.

Hippolyte spinus, SOW.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 30—40 m.; The Skjerstad Fiord XVI; Reine I, 150 m.; Balstad, 150 m.; Henningsværstrømmen, 20—40 m.; The Kanstad Fiord, 30—90 m.; Gaukværø II, 250 m.; Malangen, 380 m.; Stønesbotn, 40—80 m.; Lyngen II, 250 m.; Kvænangen II, 90 m.; The Jøkel Fiord, III, 100 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Females bearing eggs with ocular spots occurred on

$^{21}/_4$ 1899, The Jøkel Fiord, 100 m.;
$^{25}/_4$ 1899, The Troldfiordsund, 40 m.;
$^{3}/_4$ 1900, The Skjerstad Fiord, 30—40 m.

Hippolyte lilljeborgi, DANIELSSEN.
(= *H. securifrons*, NORMAN).

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord X, 10—30 m.; The Skjerstad Fiord XIII, 110 m.; The Øxsund, 600 m.; The Sag Fiord, 200 m.; Landego, 200—450 m.; The Kirk Fiord III, 70—80 m.; Mortsund, 200 m.; The Østnes Fiord, 130 m.; Malangen, 380 m.; The Porsanger Fiord, 70 m.

Females bearing eggs with ocular spots occurred on

$^{30}/_3$ 1900, Landego, 200—450 m.;
$^{2}/_4$ —, The Skjerstad Fiord III, 230 m.;
$^{3}/_4$ —, The Skjerstad Fiord X, 10—30 m.

Hippolyte polaris, SABINE.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord X, 10—30 m.; The Skjerstad Fiord XVI; The Tys Fiord I, 500 m.; Røsthavet, 300—500 m.; Moskenstrømmen, 200 m.; The Kirk Fiord III, 30—50 m.; The Øgs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Tranødybet, 450—530 m.; Stønesbotn, 40—80 m.; Malangen, 100—200 m.; The Jøkel Fiord III, 100 m.; Ingøhavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

Females bearing eggs with ocular spots occurred on

$^{28}/_3$ 1899, The Tys Fiord I, 500 m.;
$^{14}/_4$ —, Malangen, 100—200 m.;
$^{27}/_4$ —, The Porsanger Fiord, 200 m.;
$^{2}/_4$ 1900, The Skjerstad Fiord II, 230 m.;
$^{4}/_4$ —, The Skjerstad Fiord XVI.

At several of the foregoing stations, males were found, these have been described as a separate species (*H. borealis*). In all of them the rostrum was without teeth or a slight indication of such could be seen. The lowest corner of the fore edge of Cephalo thorax was rounded.

Bythocaris simplicirostris, G. O. SARS.

Tranødybet, 607—640 m.; Malangen, 100—200 m.

Cryptocheles pygmæa, G. O. SARS.

The Folden Fiord, 530 m.; Tranødybet, 607—640 m.

At the former place females bearing eggs, without ocular spots, occurred on $^{6}/_4$ 1900.

Eupagurus bernhardus, LIN.

The Salten Fiord I, 15—20 m.; Grøtø, 6—24 m.; Napstrømmen, 30—40 m.; Svolvær, 15—20 m.; Troldfiordsund, 40 m. (2 small specimens).

Females bearing eggs with ocular spots occurred on

$^{5}/_4$ 1900, The Salten Fiord I, 15—20 m.

Eupagurus pubescens, KRØYER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 30—50 m.; The Skjerstad Fiord XVI, 10—100 m.; Røst I, 120 m.; Moskenstrømmen, 200 m.; Reine, 150 m.; Balstad, 150 m.; Stene (Vest Fiord), 120—200 m.; The Østnes Fiord, 20 m.; Digermulen, 100—150 m.; Grøtø, 6—24 m.; The Kanstad Fiord, 30—90 m.; Gaukværø II, 250 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Troldfiordsund, 40 m.; Ingøhavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.; Sværholt (1894).

Females bearing eggs with ocular spots occurred on

$^{14}/_4$ 1899, Malangen, 100—200 m.;
$^{24}/_4$ —, Ingøhavet, 300 m.;
$^{35}/_4$ —, Breisund, 100 m.

Lithodes maia, LIN.

Malangen, 100—200 m.; The Kjølle Fiord (1894).

Galathea nexa, EMBLETON.

Balstad, 20 m.; Henningsværstrømmen, 20—40 m.

Galathea dispersa, BATE.

The Beier Fiord, 50—150 m.

As far as I know, this species has not previously been found north of the arctic circle. The Beier Fiord must now be considered to be its limit to the north.

Galathea intermedia, LILLJEBORG.

Henningsværstrømmen, 20—40 m.; Svolvær (1894).

Galathodes tridentatus, ESMARK.

The Tys Fiord I, 500 m.; Tranødybet, 450—530 m.

At both places, the species was found on *Lophohelia* bottom. Tranødybet is the northern limit, as far as is known at present.

Munida rugosa, FABR.

The Beier Fiord, 50—150 m.; Arnø, 300—400 m.; Landego, 200—450 m.; The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; The Tys Fiord I, 500 m.; Moskenstrømmen, 200 m.; Reine, 150 m.; Balstad, 150 m.; Mortsund I, 200 m.; Ure I, 200—250 m.; Svolvær (1894); Brettesnes—Skroven, 350—400 m.; Digermulen, 100—150 m.; Gaukværø II, 250 m.; Malangen, 100—200 m.; Lyngen III, 300 m.

Females bearing eggs without ocular spots occurred on

16/2 1899, Brettesnes—Skroven, 350—400 m.;
24/4 —, Ingøhavet, 300 m.
26/3 —, Balstad, 150 m.

Munida tenuimana, G. O. SARS.

The Folden Fiord, 530 m.; Oxsund, 600 m.; The Tys Fiord, 500 m.; Brettesnes—Skroven, 350—400 m.; Tranødybet, 607—640 m.

Hyas araneus, LIN.

The Misvær Fiord (arm of the Skjerstad Fiord), 10—50 m. (1 female carrying eggs).

Hyas coarctatus, LIN.

The Misvær Fiord, 10—50 m.; The Salten Fiord I, 15—20 m.; Røst II, 150 m.; Moskenstrømmen, 90 m.; The Kirk Fiord III, 70—80 m.; Balstad, 15—30 m.; Stene in Bø, from the stomach of cod; Malangen, 100—200 m.; Stønesbotn, 40—80 m.; The Jøkel Fiord, 100 m.; The Porsanger Fiord, 200 m.

Portunus depurator, LIN.

The Salten Fiord I, 15—20 m.; Troldfiordsund, 40 m.

As far as I know, this species has not previously been found so far north.

Portunus holsatus, FABR.

Stene in Bø (Vesteraalen), from the stomach of *Pleuronectes platessa*.

It is not likely that this species has been previously noted from Lofoten. Its northern limit must now be taken to be Vesteraalen.

Portunus pusillus, LEACH.

Mortsund II, 200 m.

This is also a new species for Lofoten.

Pantopoda.[1])

Dr. APPELLØF, Bergen, determ.

Pycnogonum litorale, STRØM.

Skjerstadfiord III, 230 m.; Kvænangen, 300—343 m.; Jøkelfiord II, 60 m.

Pseudopallene circularis, GOODSIR.

Skjerstadfiord X, 10—30 m.; Balstad, 30 m.; Napstrømmen, 30—40 m.

Pseudopallene spinipes, FABR.

Napstrømmen, 30—40 m.; Stønesbotn, 40—80 m.; Hammerfest (1894); Troldfiordsund, 40 m.; Nordkap (1894).

Nymphon glaciale, LILLJEBORG.

Mehavn (1894). New for the Norwegian fauna.

Nymphon grossipes, FABR.

Øgsfiord, 100 m.; Troldfiordsund, 40 m.; Nordkap (1894); Sværholt (1894).

Nymphon mixtum, KRØYER.

Kirkfiord II, ca. 50 m.

Nymphon leptocheles, G. O. SARS.

Morsdalfiord, 50 m.; Malangen, 380 m.

Nymphon strömi, KRØYER.

Morsdalfiord, 50—150 m.; Balstad (Lofoten); Risværflaket, 150—180 m.; Kanstadfiord, 30—90 m.; Arnø, 300—400 m.; Ostnesfiord, 50—70 m.; Jøkelfiord III, 100 m.

Nymphon macrum, WILSON.

Foldenfiord, 530 m.; Øgsfiord I, 100 m.; Malangen, 100—200 m.

Chætonymphon hirtipes, BELL.

Balstad (Lofoten), 10—35 m.; Malangen, 100—200 m.; Jøkelfiord III, 100 m.; Kvænangen II, 90 m.; Breisund, 100 m.; Nordkap (1894); Porsangerfiord, 200 m.

Chætonymphon spinosum, GOODSIR.

Arnø, 300—400 m.; Saltenfiord II, 320—380 m.; Morsdalfiord, 50—150 m.; Reine I (Lofoten), 150 m.; Malangen, 100—200 m.

Tunicata.

Synascidiae.

H. HUITFELDT-KAAS, Kristiania, determ.

Aplidiopsis sarsi, HUITF.-KAAS.

Hammerfest (1894).

According to HUITFELDT-KAAS[2]) this species has previously been collected by M. SARS at Kristiansund and Beian.

Amaroucium mutabile, M. SARS.

Hammerfest (1894); Troldfiordsund, 40 m.

SARS collected his specimens too at Hammerfest.

---

[1]) Cf. G. O. SARS, Pycnogonidea. The Norw. North Atl. Exp. 1876—78.
[2]) The Norw. North Atl. Exp. Synascidiae, p. 15.

Ascidiae simplices.

Dr. R. Hartmeyer, Berlin, and Dr. Johan Kiær, Kristiania, determ.

Ciona intestinalis, Lin.

Moskenstrømmen, 90 m.; The Tys Fiord I, 500 m.; Sunderø (1897) in the stomach of cod.

According to Kiær,[1] the species occurs all along the coast of Norway. It has however, probably never before been collected at a depth of 500 m. At several places in Lofoten, 1897 in March and in April, I found *Ciona* in the stomach of cod.

Ascidia gelatinosa, Kiær.

Mortsund I, 200 m.; Tranødybet, 607—640 m.; Øxsund, 600 m.; The Sag Fiord, 200 m.

Hartmeyer[2] mentions this species as being found at Tromsø, which is, I believe, its most northerly locality.

Ascidia prunum, O. F. Müll.

The North Cape (1894).

Ascidia conchilega, O. F. Müll.

Mortsund I (The Vest Fiord), 200 m.

Styela rustica, Lin.

Svolvær (1894).

Dendrodoa aggregata, Rathke.

Henningsvær (from stomach of cod); Troldfiordsund, 40 m.; Breisund, 100 m.; Nordkyn (1894). In the Breisund this species was so abundant that it almost filled the dredging-net after a short draw.

Polycarpa libera, Kiær.

The Skjerstad Fiord IV, 330 m.

Kiær[3]) writes: „Found only in Komag Fiord, Øx Fiord and at Vadsø.“ This species must be considered as an arctic one. The Skjerstad Fiord is its southern limit, as far as is now known.

Cynthia echinata, Lin.

Nordkyn (1894).

Pisces.

Prof. Collett and the author determ.

Sebastes marinus, Lin.

$^{12}/_{2}$ 1897. Sunderø in Vesteraalen, from the stomach of cod.

Centridermichthys uncinatus, Reinh.

$^{31}/_{3}$ 1900, The Beier Fiord, 50 m. (several specimens); $^{7}/_{4}$ 1899, Reine, 100 m. (1 specimen); $^{14}/_{4}$ 1899, Malangen, 100—200 m. (1); $^{15}/_{4}$ 1899, Stønesbotn, 40—80 m. (1); $^{25}/_{4}$ 1899, Breisund, 100 m. (1).

Centridermichthys hamatus, Krøyer.

$^{6}/_{3}$ 1899. Henningsvær, 150 m. (1); $^{20}/_{4}$ 1899, The Jøkel Fiord II, 80 m. (1); $^{24}/_{4}$ 1899, Ingøhavet, 300 m. (1); $^{25}/_{4}$ 1899, Breisund, 100 m. (4).

[1]) The Norw. Atl. Exp. A List of Ascidiae simplices, p. 3.

[2]) Holosome Ascidien, p. 36. Meeresfauna von Bergen.

[3]) The Norw. North Atl. Exp. A List of Norwegian Ascidiae simplices, p. 12.

Triglops pingeli, Reinh.

$^{25}/_{4}$ 1899. Breisund, 100 m. (1).

Cottus scorpius, Lin.

Sværholt (1894); $^{20}/_{4}$ 1896, Napstrømmen, 40 m.

Cottunculus microps, Collett.

$^{3}/_{5}$ 1899, The Lyngen Fiord II, 250 m. (1).

Agonus cataphractus, Lin.

$^{25}/_{4}$ 1898, Breisund, 100 m. (1).

Chirolophis galerita, Lin.

$^{3}/_{4}$ 1900, The Skjerstad Fiord X, 10—30 m. (several specimens). At the mouth of the Misvær Fiord, we got the dredging bag full of *Lithothamnia,* in whose openings a multitude of animals were hidden, there were ophuirides, asterides, worms, molluscs, crabs etc.

Among these stone algae which are generally called „ruggel“ by the Norwegian fishermen, many specimens of *Chirolophis galerita* were found. Some lumps of „ruggel“ were left lying on the deck during the night. The next morning, I broke up one of the lumps, and a living specimen of *Chirolophis* came into view, it had — so to say — spent a night on „dry land“. When at rest, this fish bends the back part of its body sideways.

Lumpenus lampretiformis, Wahlb.

$^{31}/_{3}$ 1900. The Beier Fiord, 50 m. (1).

Anarrhichas lupus, Lin.

$^{23}/_{4}$ 1896. Balstad.

Contents of stomach: — *Ophiuroidea, Onuphis conchylega, Buccinum undatum, Eupagurus pubescens.*

Crystallogobius linearis, Düb. & Kor.

$^{10}/_{3}$ 1899. The Trold Fiord in Lofoten, several specimens from the stomach of *Gadus callarias.* The cod was 40 cm. in length.

Pleuronectes cynoglossus, Lin.

$^{15}/_{4}$ 1899. Stønesbotn, 50—80 m. (3).

Pleuronectes platessa, Lin.

$^{10}/_{4}$ 1899. Stene in Bø (Vesteraalen), several large specimens, with stomach and intestines full of shells *(Pecten)* and *Echinodermata.* There were also *Polychæta, Eupagurus pubescens, Portunus holsatus* etc.

Platysomatichthys hippoglossoides, Walb.

$^{20}/_{4}$ 1896. Balstad, from the stomach of cod.

Drepanopsetta platessoides, O. Fabr.

$^{31}/_{3}$ 1900. The Beier Fiord, 50—150 m. (several specimens).

Gadus aeglefinus, Lin.

$^{29}/_{4}$ 1897. Reine, one specimen (28 cm.) from the stomach of cod.

I have written something about the food of the haddock in my paper: — „Contribution to the Study of Hydrography and Biology on the Coast of Norway“, p. 17.

Gadus callarias, Lin.

At several places we caught cod and examined the contents of their stomachs, we also bought some for the same purpose. On

$^{10}/_4$ 1899, we examined some cod which had been caught at Stene in Bø. Some were of a reddish colour, others were paler and resembled ocean-cod („skrei").

The roe was not fully developed.

In the stomachs were found *Polychæta, Hyas coarctatus* etc.

A single specimen had *Lernæa branchialis* on one of its gills.

On $^{20}/_4$ 1899 we bought in the Jøkel Fiord 10 cod which had been fished by line in the fiord. Shape and colour were those of the ocean-cod („skrei"), in a few of the larger females the roe was very loose. Schizopods and Amphipods were found in the stomachs.

I have also referred to the food of the cod in the paper quoted above, p. 14.

Gadus virens, Lin.

In the beginning of February, 1897, I took part in a fishing expedition with nets for „skrei". In the course of this, we also caught a number of „sei" *(Gadus virens).* Cf. my paper referred to above, p. 17.

Molva molva, Lin.

Towards the end of April 1897, I went with a fisherman to fish with nets near Røst. Among the rest, we also caught large specimens of *Molva.* As a rule the stomach hang like a balloon out of its mouth, but in one instance, bones of *Gadus æglefinus* could be identified.

Brosmius brosme, Asc.

In the stomach of *Brosmius*, which was caught near Røst in April 1897, *Lithodes maja* was often found.

Lycodes sarsi, Collett.

$^{6}/_4$ 1900. The Folden Fiord, 530 m. (1).

Mallotus villosus, O. F. Müll.

On $^{25}/_4$ 1899, dead specimens were found drifting in the Troldfiordsund (between Rolfsø and Ingø). Both males and females were found, and on examination it was seen that they had spawned. It is said that it is quite usual to find dead capelan floating in Finmark in the spring, and many theories have been started to offer an explanation for this. Some think that the death of the capelan is to be accounted for by the coldness of the water; others suppose that it must be attributed to unsuitable food etc.

But none of the theories advanced seem very satisfactory.

Clupea harengus, Lin.

$^{18}/_3$ 1896. Henningsvær, from the stomach of cod.

Herring catches are made in many of the fiords in Nordland in the winter, so as to provide bait for the codfishery in Lofoten.

The supply of the socalled baiting herring („agnsild") is conveyed by small steamers. On $^{16}/_3$ 1897 I went on board one of these steamers (S/S „Svolvær") from Svolvær in Lofoten to the Ler Fiord in Helgeland, where a quantity of herrings had been caught. On $^{17}/_3$ I examined the plankton at the bottom of the fiord at the place where the catch had been made. It was not very rich. On the surface, I got a few specimens of *Oithona similis*, as well as nauplii of *Copepoda.* In a sample from 0—25 m. were found the following: —

Cal. finmarchicus r
Pseudocal. elongatus r
Acartia longiremis rr
Microsetella atlantica c
Metridia longa rr
Nauplii of Copepoda +

Temperature and salinity were found to be distributed as follows: —

$^{17}/_3$ 1897, The Ler Fiord.

	t.	s.
0 m.	3°,5 C.	33,04 ‰
10 „	3,8 -	33,73 „
Bottom 25 „	3,8 -	33,73 „

The herrings were rather meagre. I made some measurements, and found that the smallest were 15 cm. in length, the largest 20 cm., the usual length was 16, 17, 18 cm. (The measurement was made from the tip of the snout to the commencement of the division of the tail fin). Indications of roe and milt were present in the largest specimens. The stomachs were empty, but most of them had a white mass in the intestine.

One of the fiords which almost always in winter supplies Lofoten with „agnsild" is the Kvænangen Fiord. My observations in this fiord ($^{24}/_1$ and $^{19}/_4$ 1899), testify great uniformity in temperature and salinity during the winter.

This probably has much to do with the fact that plankton Copepods may be found right up to the surface of the water. At any rate, I observed quantities of *Calanus finmarchicus* in a sample from 0—5 m. on $^{24}/_1$ 1899.

As the food of the herring can thus rise so far up, it is explicable that the herring itself follows it, and comes so far up in the water that it can be reached by the tackle employed.

Anguilla vulgaris, Turt.

$^{5}/_4$ 1900. The Salten Fiord I, 15—20 m. *(juniores).*

Myxine glutinosa, Lin.

During the cod fishery at Sunderø in Vesteraalen, in the beginning of February 1897, I noticed that large numbers of fish were destroyed by this destructive animal. In some cases the robbers had not had a chance of escape, but were found under the skin of the sucked out cod.

B. Bottom Samples.

a. Foraminifera.

Mr. Hans Kiær, Tromsø, determ.

At some places, we took bottom samples, and when the townet reached the bottom, we also obtained a combination of bottom mud and plankton.

These samples were sent to Mr. Ed. Thum, Leipzig, and he sorted out the *Foraminifera* and the *Diatomacea* and made excellent preparations. Mr. Hans Kiær and Mr. E. Jørgensen have classified the species thus prepared.

In the following pages, I give the list of the *Foraminifera* from Mr. Kiær's Manuscript.

With regard to the synomyms, I beg reference to the works of the author himself.[1])

11/1 1899, Moskenstrømmen, 0—150 m.
Bottom sample and plankton.

Hyperammina ramosa, Hyperammina subnudosa, Crithionina abyssorum, Halophragmium bulloides, Valvulina conica, Ammodiscus tenuis, Reophax scorpimus, Trochammina robertsoni, Trochammina nitens, Webbina clavata, Verneuilina polystropha, Textularia agglutinans, Bulimina pyrula, Bulimina marginata, Virgulina schreibersiana, Uvigerina angulosa, Cassidulina laevigata, Nodosaria laevigata, Globigerina bulloides, Truncatulina lobatula, Truncatulina refulgens, Anomalina coronata, Operculina ammonoides, Nonionina umbilicatula, Nonionina turgida.

17/1 1899, Stamsund.
Bottom sample.

Haplophragmium canariense, Haplophragmium glomeratum, Valvulina conica, Bulimina pyrula, Bulimina elipsoides, Bulimina marginata, Bolivina punctata, Cassidulina bradyi, Chilostomella ovoidea, Uvigerina pygmaea, Uvigerina angulosa, Pullenia sphaeroides, Pullenia quinqueloba, Truncatulina lobatula, Anomalina coronata, Nonionina umbilicatula, Operculina ammonoides, Cornuspira carinata, Quinqueloculina seminulum, Biloculina simplex.

17/1 1899, Stamsund, 0—150 m.
Bottom sample and plankton.

Trochammina inflata, Bigenerina sarsi, Bulimina marginata, Bulimina convoluta, Bulimina pyrula, Bolivina punctata, Uvigerina angulosa, Sagrina dimorpha, Patellina corrugata, Cassidulina laevigata, Polymorphina compressa, Cornuspira foliacea, Nodosaria calomorpha, Lagena marginata, Lagena hexagona, Lagena apiculata, Cristellaria rotulata, Globigerina bulloides, Pullenia sphæroides, Truncatulina lobatula, Nonionina scapha, Operculina ammonoides, Quinqueloculina seminulum, Biloculina elongata.

31/1 1899, Høla (Svolvær), 0—150 m.
Bottom sample and plankton.

Halophragmium truncatum, Trochammina robertsoni, Bolivina dilatata, Bolivina punctata, Virgulina schreibersiana, Bulima subteres, Bulima marginata, Cassidulina laevigata, Cassidulina crassa, Polymorphina compressa, Patellina carrugata, Lagena marginata, Lagena laevis, Lagena striata, Truncatulina lobatula, Discorbina globularis, Nonionina scapha, Operculina ammonoides, Quinqueloculina seminulum, Biloculina elongata, Biloculina oblonga, Globigerina bulloides.

31/1 1899, Høla (Svolvær), 0—150 m.
Bottom sample and plankton.

Reophax scorpiurus, Halophragmium glomeratum, Trochammina robertsoni, Valvulina conica, Valvulina fusca, Trochammina nitida, Bulima elipsoides, Bulima pyrula, Bulima marginata, Bolivina punctata, Bolivina dilatata, Virgulina squamosa, Uvigerina angulosa, Sagrina dimorpha, Cassidulina crassa, Cassidulina laevigata, Lagena striata, Lagena clavata, Lagena distoma, Lagena hexagona, Lagena marginata, Globigerina bulloides, Pullenia sphæroides, Truncatulina lobatula, Discorbina obtusa, Operculina ammonoides, Nonionina stelligera, Nonionina turgida, Triloculina tricarinata, Quinqueloculina seminulum.

31/1 1899, Lilands Bay (Østnesfjord), 0—35 m.
Bottom sample and plankton.

Trochammina sp., Spiroplecta biformis, Uvigerina angulosa, Cassidulina crassa, Cassidulina laevigata, Virgulina schreibersiana, Bulimina marginata, Bolivina dilatata, Nodulina gracilis, Polymorphina compressa, Nodosaria communis, Nodosaria calomorpha Patellina corrugata, Lagena squamosa, Lagena williamsoni, Lagena gracilis, Lagena striata, Lagena marginata, Truncatulina lobatula, Nonionina scapha, Operculina ammonoides, Quinqueloculina seminulum.

3/2 1899, Raftsund, 250—300 m.

Hyperammina sp., Trochammina robertsoni, Valvulina fusca, Valvulina conica, Textularia agglutinans, Textularia williamsoni, Bigenerina sarsi, Bigenerina digitata, Bolivina punctata, Bolivina dilatata, Bulimina marginata, Bulimina pyrula, Bulimina elipsoides, Uvigerina angulosa, Sagrina dimorpha, Cassidulina laevigata, Cassidulina crassa, Globigerina bulloides, Pullenia sphaeroides, Pullenia quinqueloba, Orbulina universa, Nodosaria scalaris, Nodosaria communis, Lagena squamosa, Lagena marginata, Truncatulina lobatula, Rotalia soldani, Discorbina araucana, Discorbina obtusa, Nonionina umbilicatula, Operculina ammonoides, Cornuspira carinata, Quinqueloculina seminulum, Biloculina simplex, Biloculina elongata.

---

1) *Thalamophora*. The Norw. North. Atl. Exp.
Synopsis of the Norwegian Marine Thalamophora. Rep. on Norwegian Fishery and Marine Investigations, edited by dr. Hjort, Vol. I, nr. 7, 1900.

Besides these, there were also found at the same place: *Saccammina sphaerica, Rhabdammina abyssorum.*

$^{5}/_{2}$ 1899, Raftsund, 0—270 m.
Bottom sample and plankton.

Trochammina robertsoni, Textularia sagittula, Bigenerina sarsi, Bulimina elipsoides, Bulimina pyrula, Bulimina marginata, Bulimina convoluta, Bulimina subteres, Bolivina punctata, Virgulina schreibersiana, Cassidulina crassa, Cassidulina laevigata, Polymorphina compressa, Sagrina dimorpha, Globigerina bulloides, Pullenia sphaeroides, Nodosaria calomorpha, Lagena semistriata, Lagena marginata, Lagena gracillima, Lagena striata, Truncatulina lobatula, Discorbina araucana, Discorbina berthelotiana, Nonionina umbilicatula, Operculina ammonoides, Cornuspira foliacea, Triloculina tricarinata.

$^{7}/_{2}$ 1899, Ofoten I, 360 m.

Bigeneria sarsi (A + B), *Bulimina normanni, Virgulina schreibersiana, Bolivina punctata, Bolivina dilatata, Bulimina elipsoides, Bulimina marginata, Uvigerina angulosa, Sagrina dimorpha, Cassidulina laevigata, Cristellaria rotulata, Nodosaria laevigata, Nodosaria scalaris, Nodosaria soluta, Nodosaria inflexa, Lagena marginata, Lagena striata, Lagena distoma, Lagena semistriata, Lagena hexagona, Globigerina bulloides, Pullenia sphaeroides, Pullenia quinqueloculina, Sphaeroidina bulloides, Truncatulina lobatula, Rotalia soldani, Discorbina berthelotiana, Anomalina coronata, Patellina corrugata, Nonionina stelligera, Nonionina umbilicatula, Operculina ammonoides, Cornuspira carinata, Quinqueloculina seminulum, Quinqueloculina arenacea.*

$^{16}/_{2}$ 1899, Brettesnes—Skroven, 350—400 m.

I.

Hyperammina ramosa, Reophax scorpiurus, Halophragmium latidorsatum, Valvulina fusca, Webbina clavata, Bulimina marginata, Uvigerina pygmaea, Nodosaria laevigata, Anomalina coronata, Rotalia soldani, Nonionina umbilicatula, Quinqueloculina arenacea.

At the same place were also found: — *Saccammina sphaerica, Bathysipton filiformis.*

$^{16}/_{2}$ 1899, Brettesnes—Skroven, 350—400 m.

II.

Trochammina sp., *Bulimina pyrula, Bulimina marginata, Bulimina subteres, Bolivina punctata, Bolivina dilatata, Virgulina schreibersiana, Cassidulina laevigata, Cassidulina crassa, Polymorphina compressa, Uvigerina angulosa, Cornuspira* sp., *Lagena orbignyana, Lagena distoma, Lagena marginata, Lagena striata, Globigerina bulloides, Pullenia sphaeroides, Patellina corrugata, Discorbina araucana, Nonionina umbilicatula, Nonionina scapha, Operculina ammonoides, Quinqueloculina subrotunda.*

$^{3}/_{3}$ 1899, The Kirk Fiord I, 100 m.

I.

Ammodiscus incertus, Virgulina squamosa, Bulimina marginata, Cassidulina laevigata, Cassidulina bradyi, Poly morphina compressa, Bolivina punctata, Bolivina dilatata, Uvigerina angulosa, Cristellaria rotulata, Nodosaria communis, Lagena lagenoides, Lagena marginata, Globigerina bulloides, Truncatulina lobatula, Discorbina araucana, Discorbina berthelothiana, Nonionina scapha, Operculina ammonoides, Quinqueloculina agglutinans.

$^{3}/_{3}$ 1899, The Kirk Fiord I, 100 m.

II.

Halophragmium latidorsatum, Halophragmium canariense, Textularia agglutinans, Textularia sagittula, Bulimina pyrula, Bulimina marginata, Bolivina dilatata, Virgulina schreibersiana, Uvigerina angulosa, Cassidulina laevigata, Cassidulina crassa, Truncatulina lobatula, Discorbina globularis, Globigerina bulloides, Nonionina scapha, Polystomella striatopunctata, Patellina corrugata, Operculina ammonoides, Quinqueloculina seminulum.

$^{4}/_{4}$ 1899, The Østnes Fiord, 10—20 m.

Reophax scorpiurus, Halophragmium canariense, Halophragmium glomeratum, Gordiammina sp., *Verneuilina polystropha, Spiroplecta biformis, Bulimina marginata, Cassidulina crassa, Cassidulina laevigata, Uvigerina angulosa, Polymorphina compressa, Lagena laevis, Lagena distoma, Lagena marginata, Truncatulina lobatula, Discorbina globularis, Rotalia beccari, Operculina ammonoides, Nonionina scapha, Polystomella striato-punctata, Quinqueloculina seminulum, Globigerina bulloides.*

$^{4}/_{4}$ 1899, Moldøren, near Svolvær, 10 m.

Bolivina dilatata, Virgulina schreibersiana, Lagena squamosa, Lagena laevis, Globigerina bulloides, Patellina corrugata, Truncatulina lobatula, Truncatulina ungeriana, Discorbina vilardeboana, Nonionina stelligera, Polystomella striatopunctata, Quinqueloculina seminulum.

1899, Svolvær harbour, 10—15 m.

Bigeneria sarsi, Bolivina dilatata, Bolivina punctata, Bulimina marginata, Cassidulina laevigata, Uvigerina angulosa, Lagena hexagona, Lagena squamosa, Lagena striata, Lagena gracillima, Lagena lagenoides, Globigerina bulloides, Pullenia sphaeroides, Truncatulina lobatula, Discorbina globularis, Rotalia beccari, Polystomella striatopunctata, Nonionina stelligera, Operculina ammonoides, Quinqueloculina seminulum, Quinqueloculina subrotunda.

$^{18}/_{1}$ 1899, Gaukværø (Vesteraalen), 0—180 m.
Plankton and bottom sample.

Textularia williamsoni, Cassidulina laevigata, Cassidulina crassa, Uvigerina angulata, Lagena hexagona, Cristellaria rotulata, Globigerina bulloides, Truncatulina lobatula, Truncatulina refulgens, Discorbina globularis, Nonionina stelligera, Quinqueloculina seminulum, Biloculina simplex.

$^{10}/_{4}$ 1899, Stene in Bø (Vesteraalen), 10 m.

Uvigerina angulosa, Cassidulina laevigata, Truncatulina lobatula, Discorbina araucana, Nonionina stelligera, Polystomella striatopunctata, Spiroloculina planulata, Triloculina tricarinata, Quinqueloculina seminulum.

Kiær has also classified several species which were not prepared.

$^{23}/_{3}$ 1900, The Østnes Fiord.

Truncatulina lobatula, Truncatulina ungeriana, Truncatulina refulgens, Anomalina coronata, Planorbulina mediterranensis.

$^{22}/_{2}$ 1899, Mortsund I, 200 m.

Nodosaria soluta, *Cristellaria rotulata*, *Cristellaria crepidula.*

$^{28}/_{3}$ 1899, The Tys Fiord, 500 m.

Pulvinulina punctulata on *Lophohelia prolifera.*

$^{18}/_{3}$ 1899, The Sag Fiord, 200 m.

Saccammina sphaerica.

$^{22}/_{3}$ 1899, The Sea NW of Røst, 700 m.

Rupertia stabilis.

$^{14}/_{4}$ 1899, Malangen, 380 m.

Astrorhiza arenacea, *Discorbina globularis.*

$^{3}/_{5}$ 1899, Lyngen III, 300 m.

Astrorhiza arenacea.

Hammerfest (1894).

Truncatulina lobatula, *Truncatulina refulgens*, *Truncatulina ungeriana*, *Discorbina globularis.*

Sværholt (1894).

Discorbina globularis, *Truncatulina lobatula.*

$^{27}/_{4}$ 1899, The Porsanger Fiord, 200 m.

Rhabdammina abyssorum.

With regard to the distribution of the *Thalamophora*, Mr. Kiær writes[1]) „In taking a survey of the occurrence of Thalamophora in all the ocean-depths investigated by the North Atlantic Expedition we find, in all, three different centres of distribution, *viz:* —

A. The southern gray clay, which includes the fiords and banks along the Norwegian coast, about as far as to 19° E. Long; and the gray clay near Iceland.

B. The northern gray clay, to which the fiords and banks along the Norwegian coast east of 19° Long., near Beeren Island and Spitzbergen belong, and the *Rhabdammina* clay.

C. The brown clay, which is divided into the *Biloculina* clay proper and the transition clay."

Kiær (l. c. p. 11) gives the following as being the forms which are of most frequent occurrence in the southern gray clay along the coast of Norway: —

Uvigerina pygmaea, *U. angulosa*, *Truncatulina lobatula*, *T. refulgens*, *Nonionina umbilicatula*, *N. scapha*, *Lagena marginata*, *Pullenia sphaeroides*, *Quinqueloculina seminulum*, *Globigerina bulloides*, *Bolivina dilatata*, *Bulimina elipsoides*, *B. marginata* and *Cassidulina laevigata.*

As characteristic of the northern gray clay, Kiær (l. c. p. 12) gives the following forms: —

Astrorhiza crassatina, *Lagena apiculata*, *Pulvinulina karsteni*, *Globigerina pachyderma.*

These are considered to be arctic forms. „On the other hand, there are some southern species which are either absent from the field of the northern centre or at any rate are very scarce, and do not attain to their full size, e. g. *Bulimina marginata*, *Uvigerina pygmaea* and *angulosa*, *Operculina ammonoides.*" [2])

The samples I have collected almost exclusively represent the southern gray clay, of which Thalamophor-fauna they certainly give a very complete illustration.

It is of considerable interest to see that the limit between the northern and southern gray clay on the Norwegian coast is fixed at 19° Long., which lies near Tromsø. Without thinking of this fact, I have, for hydrographical and zoological reasons (cf. Part IV) fixed Malangen as the boundary fiord or rather the transition fiord between the preponderant boreal and the preponderant arctic fauna.

This division is thus confirmed by a study of the deposits.

---

[1]) *Thalamophora*, p. 10. The Norw. North Atl. Exp. 1876—78.

[2]) With respect to the chemical condition of the deposits, reference should be made to Schmelck's treatise „On Oceanic Deposits". The Norw. North Atl. Exp. Chemistry. A plate is adjoined giving the distribution of the deposits.

b. Diatoms in Bottom Samples from Lofoten and Vesteraalen.

By

E. JØRGENSEN.

In the following pages an account is given of the diatoms contained in some bottom samples from the following localities in Lofoten and Vesteraalen;

Moskenstrømmen, 0—180 m. (together with plankton),
Stamsund, 0—150 m. (together with plankton),
Svolvær harbour, 10—15 m.,
The Østnes Fiord, 10—20 m.,
Brettesnes—Skroven, 350—400 m.,
Mouth of the Raftsund, 250—300 m.,
Stene in Bø, 10 m.,
Gaukværø, 0—180 m. (together with plankton).

Two of these, the samples from Brettesnes—Skroven and from Raftsund, were poor and consisted perhaps only of dead specimens, a good many of which naturally originate from the plankton. The samples from Moskenstrømmen, Stamsund and Gaukværø were taken together with plankton.

The working through of bottom samples is a very troublesome and lengthy task, when it is done as it should be. As there was, however, not time enough to investigate the samples in the manner I consider the right one, and as — on the other hand — it was of some importance, to be able rightly to interprete the plankton, to gain a preliminary knowledge of the bottom flora, I have contented myself with the method usually adopted, and have studied the species from the valves in slides. For this purpose the material — together with a richer one from the west coast of Norway — has been prepared as slides by Mr. THUM of Leipzig, in his well-known perfect way.

For this reason, it has not been possible to discern between living (recent) and fossil species.

The species occurring in the plankton are in detail dealt with in another chapter of this work (pp. 90—108). Nevertheless, to avoid arbitrariness, I have not omitted the plankton species, but have in such cases mentioned them as originating from the plankton.

List of the species observed.

I. Centricæ SCHÜTT.

I. *Coscinodisceæ*.

Coscinodiscus EHRB.

C. nitidus GREG.

Cf. above p. 95.

Somewhat rare: Moskenstrømmen r, Stamsund r, Raftsund r, Stene r, Gaukværø r.

Distribution: Western Europe; Balearic Islands. Greenland and Finmark (CLEVE). Warmer coasts of America, Asia and Australia.

C. appollinis EHRB. (1844).
EHRB. Mikrogeologie pl. 35 A, XXII, f. 4.

var. compacta RATTR. Rev. of Coscinod. p. 579.
C. scintillans (GREV.) A. SCHMIDT Nords. Diat. p. 94, pl. 3, f. 33.

Differs from the main species (= *C. scintillans* GREV.) in having the puncta distinctly smaller towards the margin, more numerous radial rows, the shortened ones being longer than usual. Probably is a separate species.

Rare: Moskenstrømmen +, Stamsund r, Svolvær r, Stene r.

Cosc. nitidus A. SCHM. Nords. Diat. pl. III, f. 32 does not show the irregular distribution of the puncta that is characteristic of the preceding species. This form occurs in my material together with the one figured l. c. f. 33 and has a similar radiate structure, only much coarser.

Distribution: The variety is only known from Solsvik (west of Bergen, Norway). The main species, which has not been found by us, occurs in the antarctic regions.

C. concavus EHRB.? GREG.
GREG. Diat. of Clyde 1857. p. 500, pl. X, f. 47. EHRB. Mikrogeol., pl. 21, f. 4? non pl. 18, f. 38.

Hardly belongs to the genus *Coscinodiscus*. RATTRAY l. c. p. 470 remarks that the girdle aspect of this species answers to *Endictya oceanica* EHRB. (cfr. Mikrogeologie pl. 35 A, XXVIII figs. 6, 7; A. SCHMIDT Atlas pl. 65, figs. 10—15).

Very rare: Gaukværø r. Diameter 86 μ; 2 areoles on 10 μ; border sharply defined, nearly 3 μ broad.

Distribution: Western Europe; Balearic Islands, Black Sea. Sea of Kara (CLEVE). Warmer coasts of America and Asia.

C. leptopus GRUN.
VAN HEURCK Synops. pl. 131, figs. 5—6.

Rare: Raftsund r. Diameter 55 μ; 5 areoles on 10 μ. Remarkable for the minute areoles on the border, like those in the genuine *C. lineatus* EHRB. It differs on the whole from the latter species only in possessing the pseudonodule.

Coscinosira polychorda GRAN and the variety of *Coscinodiscus lineatus* mentioned below have a much finer structure and less regularly straight rows of areoles.

Distribution: Mediterranean. Southern Atlantic, Pacific Ocean, Indian Ocean.

C. lineatus EHRB., ***var.***

Cf. above p. 92.

Rare: Stamsund, r. Finer structure than in the genuine *C. lineatus*. Small; $7^{1}/_{2}$—8 areoles on 10 μ. Border narrow, striate, 15 striæ on 10 μ. Areoles near the border somewhat smaller. Secondary rows somewhat flexuose.

In the sample from Svolvær a very similar specimen was found, only with a little finer structure and marginal spines. This

specimen agrees completely with *Coscinosira polychorda* GRAN, but wants the peculiar transverse processus of the latter species.

Such forms, which are perhaps solitary cells of *Coscinosira*, may easily be mistaken for *C. lineatus*.

Distribution: The main species is cosmopolitan. CLEVE and OSTRUP mention *C. lineatus* from several arctic localities: Finmark, Baren Eiland, Greenland, Spitzbergen, Kara. I should, however, think that the species has been confounded with *Coscinosira polychorda*, at any rate to some extent.

C. excentricus EHRB.

Cf. above p. 92.

Frequent: Moskenstrømmen r, Stamsund +, Gaukværø r +. Derived undoubtedly from the plankton.

Distribution: Cosmopolitan.

C. Kützingii A. SCHM.

A. SCHM. Atlas, pl. 57, f. 17. *C. marginatus* A. SCHM. Nords. Diat. pl. 3, f. 35.

As GRUNOW remarks, this species is intermediate between *C. excentricus* and the difficult group of *C. subtilis*.

Very rare: Raftsund r, Stamsund r.

Distribution: North Sea. Arctic and antarctic regions (GRUN.). Not mentioned by CLEVE as arctic. Very nearly related forms are found near Greenland (*C. adumbratus* ØSTR.) and Jan Mayen (1898, E. JØRGENSEN).

C. Rothii (EHRB.?) GRUN.

GRUN. Diat. Franz Jos. Land, p. 29, pl. III (C), figs. 20 a, b, 22. *C. symmetricus* A. SCHM. Atlas pl. 57, figs. 25—27, non GREV. *Heterostephania Rothii* EHRB. α *octonaria* Mikrogeologie 35 A, XIII B, fig. 4 a.

Belongs to the difficult group of *C. subtilis* EHRB., as well as the following species and a good many more, which probably will not bear a more thorough examination.

Structure plainly fasciculate, with numerous fasciculi separated by radial lines made conspicuous by the marked inner ends of the beginnings of new rows. Small marginal apiculi in the middle of the fasciculi, one in each. Valve almost flat (occasionally undulated according to GRUNOW).

Very rare: Stamsund r, Raftsund r, Brettesnes—Skroven r. Probably a plankton form.

Distribution: Belgium, Scotland; Caspian Sea. Warmer regions of America and Asia. Southern Seas.

C. Normanni GREG.

GREG. Quart. Journ. Micr. Sc. 1859, p. 80, pl. 6, fig. 3. *C.* „*normanicus*" VAN HEURCK Synops. pl. 131, I. *C. fasciculatus* A. SCHM. Nords. Diat. pl. III, figs. 41, 42; Atlas pl. 57, figs. 9, 10.

Very closely related to the preceding species. Differs in having a distinctly convex valve, finer structure (though variable in this respect), more numerous and narrow fasciculi and less distinct marginal apiculi.

It is perhaps not quite certain that this species is identical with *C. Normanni* GREG.; the name *C. fasciculatus* A. SCHM. (1874) must however be abolished on account of *C. fasciculatus* O'MEARA (1867).

This species seems to me to answer tolerably well to *C. punctulatus* GREG. In specimens with fine structure the fasciculi are only seen with difficulty, while the clear, scattered dots mentioned by GREGORY l. c. are conspicuous. If this should prove correct, the *C. Normanni* GREG. is perhaps the same as *C. Rothii* GRUN.

Rather frequent: Stamsund r +, Svolvær r +, Brettesnes—Skroven r, Østnesfiord r +, Stene r. Probably a plankton species (living or fossil).

Distribution: Western Europe. America. Arafura Sea.

C. curvatulus GRUN.

Cf. above p. 92.

Derived undoubtedly from the plankton.

Very rare: Stene rr.

Distribution: Arctic regions; Northern European coasts; Balearic Islands. America and Africa.

C. stellaris ROP.

Cf. above p. 92.

Derived undoubtedly from the plankton.

Very rare: Gaukværø r. When the conspicuous star is wanting, the species is difficult to determine.

var. symbolophorus (GRUN.).

C. symbolophorus GRUN. Diat. Franz Jos. Land, p. 82, pl. IV (D), figs. 3—6.

Differs from the main species in having much coarser structure.

Very rare: Moskenstrømmen r, Raftsund r. Like the main species planktonic.

Distribution: The main species occurs in Western Europe, the Mediterranean and the antarctic regions, the variety in the arctic and antarctic regions.

C. concinnus W. SM.

Cf. above p. 93.

Derived undoubtedly from the plankton.

Very rare: Gaukværø, rr; Stene, r.

Distribution: Cosmopolitan.

C. centralis EHRB., RATTR.

Cf. above p. 93.

Derived probably from the plankton.

Not unfrequent: Moskenstrømmen r, Stamsund r, Raftsund r, Stene r.

Distribution: Cosmopolitan.

C. subbulliens JØRG.

C. oculus iridis auct. scand., p. p.

Cf. above p. 94.

Probably derived from the plankton.

Rare: Moskenstrømmen r, Raftsund r, Gaukværø r +.

Distribution: Arctic regions.

C. borealis BAIL.

BAIL. Americ. Journ. Sc. 1856, p. 3. A. SCHM. Atlas, pl. 63, f. 11.

Very rare: Raftsund, rr. Diameter 135 μ. Coarse structure; areoles increasing towards the border, at the centre $3^1/_2$, near the border 2 on 10 μ; the largest ones only little larger than those at the very margin. Large and very conspicuous „papillæ" (poroides).

Border sharply defined, dark, striate. The disc somewhat convex towards the border.

The specimen found only differs from SCHMIDT's figure in wanting the „central space". Instead of this space, which is, however, not mentioned by RATTRAY l. c., a large areole was present.

Distribution: Pacific Ocean, especially in the northern region (Kamtschatka Sea, BAILEY). Cape Wankarema (CLEVE).

C. decrescens GRUN.

GRUN. Diat. Franz Jos. Land, p. 28. A. SCHMIDT Atlas, pl. 61, figs. 7—9. RATTRAY l. c. p. 77.

Perhaps a plankton form, occurring with us like *C. subbulliens*. Coarse structure, conspicuous „papillæ". Recognizable through the rapid decreasing of the areoles outside of $^1/_2$ radius.

Rare: Moskenstrømmen r +, Stamsund r. Diameter 92 µ or less; largest areoles somewhat outside of $^1/_2$ radius, 2 on 10 µ, at the centre smaller, on the border much smaller. Border broad, sharply defined, striate, with 5—6 striæ on 10 µ. Central space generally absent (answering to *var. repleta* GRUN. l. c.), sometimes present.

Distribution: Færøe Channel, Franz Josef's Land, Japan, Macassar Straits, Florida.

C. radiatus EHRB.

Cf. above p. 92.

Probably derived from the plankton.

Rather frequent: Moskenstrømmen c, Stamsund r +, Svolvær r, Østnesfiord r, Gaukværø +, Stene r.

Distribution: Cosmopolitan.

var. minor A. SCHM.

A. SCHM. Nords. Diat. p. 94, pl. 3, f. 4. *C. devius* A. SCHM. Atlas, pl. 60 figs. 1—4.

Stamsund r, Svolvær r, Gaukværø r, Stene r.

var. oculus iridis (EHRB., RATTR.).

Flat. A conspicuous central rosette and often a small „central space". Areoles largest at or beyond $^1/_2$ radius, hexagonal, with large „papilla", towards the border rapidly decreasing, at the very margin small. Largest areoles 3 on 10 µ.

This form, which answers very well to *Coscinodiscus oculus iridis* EHRB. Mikrogeologie pl. 19, fig. 2, is certainly not specifically distinct from *C. radiatus*, intermediate forms being rather frequent.

Moskenstrømmen r, Gaukværø r. Occurred also in other samples.

C. nodulifer JAN.

JANISCH. in A. SCHMIDT Atlas, pl. 59, f. 21.

Flat. A small, but conspicuous nodule near the centre. Areoles hexagonal, increasing from the centre to $^3/_4$ radius, here 3 on 10 µ; towards the margin rapidly decreasing, at the border 5—6 on 10 µ. Border sharply defined, striate, with 6—6$^1/_2$ striæ on 10 µ.

Answers very well to the figure referred to.

Rare: Raftsund +, Brettesnes—Skroven r.

Distribution: This southern species is found near the Balearic Islands and in the warmer regions of the Atlantic, Pacific and Indian Oceans.

It is very remarkable that this species occurs so far north. It is probably a plankton form, most likely a fossil one.

Actinocyclus EHRB.

A. alienus GRUN.

GRUN. in VAN HEURCK Synopsis, pl. 125, f. 12 *(var. arcticus).*

Very rare: Brettesnes—Skroven r; Stene r. In structure *Coscinodiscus*-like, as GRUNOW states intermediate between *C. curvatulus* and *C. radiatus*. Central space circular, conspicuous, only with a few irregularly scattered puncta. Numerous fasciculi (over 20) with interfascicular radii, which are more or less plainly zigzag bent, especially towards the centre. Towards the margin, the fasciculi are not separated from each other, but form an even radiately structured marginal part. Very small and inconspicuous marginal apiculi. Border narrow, indistinctly striate.

Diameter 61—66 µ; rows of areoles 15 on 10 µ, at the margin closer. Ocellus marginal, evident.

Distribution: Cape Wankarema. Also mentioned from a few places of the North Atlantic and Arctic Seas.

A. Ehrenbergi RALFS.

Cf. above p. 95.

Probably derived from the plankton.

Not unfrequent: Stamsund r, Svolvær r, Gaukværø r, Stene +.

Distribution: Cosmopolitan.

A. Ralfsii (W. SM.) RALFS.

Cf. above p. 95.

More frequent in the bottom samples than in the plankton (from which however must not be concluded that it is a bottom form): Stamsund r, Svolvær r +, Ostnesfiord r, Gaukværø r +, Stene r.

Distribution: Western Europe. Greenland (OSTRUP). Warmer Seas.

A. sparsus (GREG.) RATTR.

RATTR. Revis. Actinoc. 1890, p. 170. *Eupodiscus sparsus* GREG. Trans. Micr. Soc. 1857. p. 81, pl., fig. 47.

The description by RATTRAY does not answer well to the figure referred to. According to this figure, it seems chiefly to differ from *A. Ehrenbergi* in being more sparsely granulated towards the centre, so that only the interfascicular radii reach the central space. It is, however, doubtful whether it can really be kept distinct from the preceding species. Also *A. moniliformis* RALFS seems to be a species very closely related to *A. Ehrenbergi*.

Specimens which seem to belong here were found in the sample from Gaukværø, r.

A. crassus V. H.

VAN HEURCK Synopsis p. 215, pl. 124, figs. 6, 8.

VAN HEURCK's figure shows interfasciculate radii, though not so evident as those of *A. Ehrenbergi*. Smaller and coarser forms of the latter species is puzzlingly similar to *A. crassus*. It is on

the whole doubtful, whether these two species always can be distinguished from each other.

A more essential difference than in the structure of the valve is found in the form of the cell (frustule). *A. crassus* has high cells, usually higher than broad, with thick walls, also in the connecting zone; here there is also a conspicuous difference in width between the two valves. *A. Ehrenbergii*, however, forms low cells, broader — often much so — than high, and the two valves have nearly the same diameter.

The valve of *A. crassus* is flat from the centre to some distance from the border, where there is a high and steep marginal zone.

Somewhat rare: Stamsund r, Raftsund r, Gaukværø r, Stene r. Occurs also in the plankton samples.

Distribution: Western Europe. After all, it is most probably identical with *Eupodiscus crassus* W. SM. (Cf. VAN HEURCK l. c. and Traité d. Diat. p. 524).

Note. In the sample from Stene, several broken valves with a rather large disc occurred, somewhat similar to *Xanthiopyxis? umbonata* GREV., cf. VAN HEURCK Traité d. Diat. p. 512, fig. 263, which cannot, however, be referred to the genus *Xanthiopyxis* EHRB., a doubtful genus including what are probably resting spores of *Chætoceros* (cf. SCHÜTT. in ENGLER and PRANTL, Natürl. Pflanzenfamil., Theil I, Abth. 1 b, p. 148). Structure rather fine, similar to that of *Coscinodiscus;* valve rather convex, with numerous large, slender, conical spines, as in the figure referred to. Undoubtedly a fossil species.

2. *Melosireæ.*

Coscinosira ***polychorda*** (GRAN) GRAN.

Cf. above p. 97.
Derived from the plankton.
Very rare: Stamsund r, Gaukværø r.
Distribution: Cf. above p. 97. As stated before (p. 196) this species seems also to occur singly, and is then easily mistaken for *Coscinodiscus lineatus.* At any rate, forms occur in which the peculiar transverse processus at the semiradius are wanting.

Thalassiosira CL.

T. gravida CL.

Cf. above p. 96.
In bottom samples the strong resting spores (endocysts) of this species occur, though seldom (much more so than would probably be the case, if this species generally „oversummers" on the bottom).
Rare: Stamsund r +, Svolvær r.
Distribution: Cf. above p. 96.

T. decipiens (GRUN.) JØRG.

Cf. above p. 96.
Undoubtedly derived from the plankton.
Rare: Stamsund r, Svolvær r, Gaukværø r +.
Distribution (of *Coscinodiscus decipiens* GRUN.): Caspian Sea. Great Britain and Ireland. West coast of Norway.

Melosira AG.

M. granulata (EHRB). RALFS.
VAN HEURCK Synopsis p. 200, pl. 87, figs. 10—12.

Fresh water species.
Very rare: Gaukværø, rr.
Distribution: Frequent in fresh water, especially in Western Europe. Franz Josef's Land.

M. Roeseana RABENH.
VAN HEURCK Synopsis p. 199, pl. 89, figs. 1—6.

Fresh water species.
Very rare: Østnesfjord, rr.
Distribution: Common fresh water species. Greenland (Østrup).

M. Borreri GREV.
GREV. in HOOK. Brit. Fl. II, p. 401. VAN HEURCK Synops. p. 198, pl. 85, figs. 5—8.

Very rare: Svolvær, rr (*var.* ad *hispid.* CASTR.).
Distribution: Frequent on the coasts of Europe. Greenland (CL.).

Paralia ***sulcata*** (EHRB.) CL.
CLEVE Diat. Arct. Sea 1873, p. 7. *Gallionella sulcata* EHRB., Mikrogeologie pl. 18, 1.

Common: Moskenstrømmen +, Stamsund c, Svolvær c, Raftsund r +, Brettesnes—Skroven r, Østnesfjord c, Gaukværø cc, Stene c.
Distribution: Frequent on the coasts of Europe and America. Arctic regions.

forma coronata (EHRB.) GRUN.
VAN HEURCK Synopsis pl. 91, f. 18. *Gallionella coronata* EHRB., Mikrogeologie pl. 38, XXII, fig. 5.

Rare: Svolvær r, Stene r.

Cyclotella KÜTZ.

C. striata (KÜTZ.) GRUN.
GRUN. in CLEVE et GRUNOW Arct. Diat. 1880, p. 119. VAN HEURCK Synopsis p. 213, pl. 92, figs. 6—10. *Coscinodiscus striatus* KÜTZ.

Rare: Stamsund r, Raftsund r, Stene r.
Distribution: Frequent in brackish water. Western Europe. Baltic Sea. Warmer parts of Asia and Africa.

C. comta (EHRB.) KÜTZ.
KÜTZ. Spec. Algar. p. 21. VAN HEURCK Synops. p. 214, pl. 92, figs. 16—22.

Fresh water species.
Very rare: Gaukværø, rr.
Distribution: Western Europe.

Hyalodiscus EHRB.

H. scoticus (KÜTZ.) GRUN.
GRUN. in Journ. Royal Micr. Soc. 1879, p. 690, pl. 21, f. 5. VAN HEURCK Synops. pl. 84, figs. 15—18. *Cyclotella* s. KÜTZ. Bacill. p. 50, pl. 1, figs. II, III.

Frequent: Stamsund r, Svolvær +, Gaukværø + c, Stene r +.
Distribution: Western Europe. Bosporus. Arctic regions.

H. subtilis BAIL.
BAIL. New Spec. p. 10, f. 12.

Perhaps only a form of the preceding species.
Very rare: Stamsund r, Stene r.
Distribution: Belgium. Scotland. Finmark (CL.). America. Asia.

H. stelliger BAIL.
New Spec. p. 10. VAN HEURCK Synops. p. 213, pl. 84, figs. 1—2.

Frequent: Moskenstrømmen +, Stamsund r +, Svolvær r, Raftsund r, Brettesnes—Skroven r, Gaukværø r, Stene r.
Distribution: Western Europe. Virgin Isles. Spitsbergen (uncertain, CL.).

Podosira ***hormoides*** (MONT.) KÜTZ.
KÜTZ. Bacill. p. 52, pl. 29, f. 84. A. SCHMIDT Nords. Diat. pl. 3, f. 40. *Melosira h.* MONT. Fl. Boliv. 1839, p. 2.

Rare: Stamsund r, Svolvær r, Raftsund r.
Distribution: Coasts of the North Sea. Greenland. West coast of South America. Adriatic Sea.

3. *Eupodisceæ.*

Roperia ***tessellata*** (ROP.) GRUN.

Cf. above p. 98.
Undoubtedly derived from the plankton.
Rare: Stamsund r +, Stene r r.
Distribution: Western coasts of Europe and Africa.

Auliscus ***sculptus*** (W. SM.) RALFS.
RALFS in PRITCH. Inf. p. 845, pl. 6, f. 3. *Eupodiscus s.* W. SM. Brit. Diat. I, p. 25, pl. 4, f. 39.

Common: Moskenstrømmen +, Svolvær c, Raftsund r, Brettesnes—Skroven r, Østnesfjord r, Gaukværø c, Stene c.
Specimens occur which are very similar to *A. cœlatus* BAIL. (A. SCHM. Atlas pl. 32, figs. 14—15), but connected with *A. sculptus* by intermediate forms: Gaukværø +, Stene r.
Distribution: Coasts of the North Sea. Western Europe. Mediterranean. America. *A. cœlatus:* Warmer coasts of the Atlantic, Pacific and Indian Oceans.

Eupodiscus ***argus*** W. SM.
W. SM. Brit. Diat., p. 24. A. SCHMIDT Atlas, pl. 92, figs. 7—11; pl. 97, figs. 7—11. VAN HEURCK Synops. p. 209, pl. 117.

Very rare: Moskenstrømmen, r r, only one broken valve.
Distribution: Frequent on the coasts of the North Sea and Western Europe. America.

Aulacodiscus EHRB.

A. Kittonii ARNOTT.
ARNOTT in PRITCH. Inf. p. 844, pl. 8, f. 24. A. SCHMIDT Atlas pl. 36, figs. 5—7.

Rare: Moskenstrømmen +, Raftsund r, Brettesnes—Skroven r, Gaukværø r.
All specimens observed have 4 processus and no, or a very small or inconspicuous, „central space".
It is very remarkable that this tropical species occurs in Lofoten. Very likely fossil. At present I have no opportunity of ascertaining whether the cells have really all been empty.
Distribution: Warmer coasts of the Pacific Ocean, especially frequent on the coasts of California.

A. Johnsonii ARNOTT.
ARNOTT in PRITCH. Inf. p. 844. A. SCHMIDT Atlas pl. 36, figs. 1, 2. *A. Kittonii var.* J. RATTR. Rev. of Aulacodisc. p. 376.

Very rare: Raftsund r, Brettesnes—Skroven r.
Differs from the preceding especially in having a conspicuous central space and processus of a different shape. *A. Kittonii* is, however, said to vary considerably.
Distribution: Tropical coasts of the Indian and Atlantic Oceans.

4. *Asterolampreæ.*

Actinoptychus EHRB.

A. undulatus (BAIL.?) RALFS.

Cfr. above p. 98.
Frequent: Moskenstrømmen r +, Stamsund r +, Svolvær r, Raftsund r, Brettesnes—Skroven r, Gaukværø r, Stene r.
Distribution: Coasts of Western Europe and the North Sea. Arctic regions. Cape of Good Hope.

A. splendens (EHRB.?) SHADB.
SHADB. in PRITCH. Inf. p. 840. VAN HEURCK Synops. pl. 119, figs. 1—2, 4. *Halionyx splendens* EHRB. Abh. Berl. Ak. 1844?

Very rare: Moskenstrømmen r, Gaukværø r r.
Distribution: Coasts of the North Sea and the Baltic (Greifswald).

Asteromphalus ***heptactis*** (BRÉB.) RALFS.

Cf. above p. 98.
Undoubtedly derived from the plankton.
Very rare: Moskenstrømmen r r.
Distribution: Cf. above p. 98.

5. *Biddulphieæ.*

Biddulphia GRAY, V. H. (including *Amphitetras* EHRB., *Triceratium* EHRB., *Cerataulus* EHRB.).

B. pulchella GRAY.
GRAY Arrang. of Brit. Plants, I, p. 294. VAN HEURCK Synops. p. 204, pl. 97, figs. 1—3.

Rare: Stamsund r, Raftsund r, Brettesnes—Skroven r, Stene r.
Distribution: Frequent on the western and southern coasts of Europe. America. Africa.

B. regina W. SM.
W. SM. Brit. Diat. II, p. 50, pl. 46, f. 323.

var.
B. regina A. SCHM. Atlas pl. 119, f. 18 (from Balearic Isles).

The 3 median elevated parts of the valve hispid, not smooth as stated by W. SM. both in his discription and figure.
Very rare: Stene, a single valve.

Distribution: Balearic Isles. The main species known from the coast of the isle of Skye.

B. aurita (LYNGB.) BRÉB.

Cf. above p. 99.
Probably derived from the plankton.
Frequent: Stamsund +, Svolvær + c, Stene r +.
Distribution: Cf. above p. 99.

B. rhombus (EHRB.) W. SM.
W. SM. Brit. Diat. II, p. 49, pl. 45, f. 320. *Denticella r.* EHRB.

var. trigona CL. VAN HEURCK Synops. pl. 99, f. 2.

Very rare: Svolvær r.
Distribution: Coasts of the North Sea and Western Europe. Finmark (CLEVE).

B. turgida (EHRB.) W. SM.
W. SM. Brit. Diat. II, p. 50, pl. 62, f. 38. VAN HEURCK Synops. pl. 104, figs. 1, 2. *Cerataulus t.* EHRB.

Very rare: Svolvær r r.
Distribution: Coasts of the North Sea and Western Europe.

B. Smithii (RALFS) V. H.
VAN HEURCK Synops. p. 207, pl. 105, figs. 1—2. A. SCHMIDT Atlas pl. 116, figs. 5—6. *Cerataulus S.* RALFS in PRITCH. p. 847.

Very rare: Moskenstrømmen rr, Svolvær r.
Distribution: Coasts of the North Sea and Western Europe. Spitsbergen? (CLEVE).

B. antediluviana (EHRB.) V. H.
VAN HEURCK Synops. pl. 109, figs. 4—5. *Amphitetras a.* EHRB., Mikrogeol. pl. 21, f. 25 a—c.

Rather frequent: Moskenstrømmen +, Stamsund r, Raftsund r, Gaukværø r, Stene r.
Distribution: Common species, cosmopolitan; very rare, however, in arctic regions: Spitsbergen (rr, CLEVE).

B. lata (GREV.).
Triceratium l. GREV. Trans. Micr. Soc. 1865, p. 103, pl. 9, f. 20. A. SCHMIDT Atlas, pl. 77, figs. 38—39. *Amphitetras l.* DE TONI Syll. vol. II, sect. 3, p. 901.

Very rare: Raftsund r. Very similar to the figures referred to in SCHMIDT's Atlas. Side of the tetragone 67 μ. Marginal pearls 5 on 10 μ; the rows of striæ in the corners somewhat radiating, 10 on 10 μ.
Distribution: Tropical species, according to DE TONI (l. c.) only known from Singapore and North Celebes.

B. favus (EHRB.) V. H.
VAN HEURCK Synops. pl. 107, figs. 1—4. *Triceratium favus* EHRB. A. SCHMIDT Atlas, pl. 82, f. 2.

Very rare: Raftsund, r r. Side of the triangle 92 μ; 2 areoles on 10 μ.
Distribution: Rather common species, cosmopolitan on tropical and temperate coasts. Spitsbergen (CLEVE, „doubtful as an arctic species").

B. arctica (BRIGHTW.).
Triceratium a. BRIGHTW. Micr. Journ. 1853, p. 250, pl. 4, f. 11. A. SCHMIDT Atlas pl. 79, figs. 12—13.

Very rare: Stene r.

forma balæna (EHRB.).
Zygoceros b. EHRB. Mikrogeol. pl. 35 A, XXIII, f. 17. *Biddulphia b.* BRIGHTW. Micr. Journ. VII (1859), p. 181, pl. 9, f. 15. VAN HEURCK Synops. pl. 112, f. 1.

Very rare: Stene r.
Distribution: Arctic regions. Vancouver; Cape of Good Hope (DE TONI Syll. p. 921).

B. formosa (BRIGHTW.).
Triceratium f. BRIGHTW. GRUN. in CLEVE et GRUN. Arkt. Diat. pp. 111—112. A. SCHMIDT Atlas, pl. 79 f. 2.

Very nearly related to the preceding species, from which it differs chiefly in having the centre of the valve irregularly punctate, not areolate, with scattered puncta smaller than the neighbouring areoles.
Very rare: Raftsund r.

forma balæna.

Answering to the *forma balæna* of the preceding species.
Very rare: Raftsund r.

B. alternans (BAIL.) V. H.
VAN HEURCK Synops. p. 208, pl. 113, figs. 4—7. *Triceratium a.* BAIL. Micr. Obs. p. 40, figs. 55—56.

Very rare: Stamsund r r.
Distribution: Western Europe. West Indies.

B. punctata (BRIGHTW.) V. H.
VAN HEURCK Synops. pl. 109, f. 10 *(forma 3-gona)*. *Triceratium p.* BRIGHTW. Micr. Journ. 1856, p. 275, pl. 17, f. 18, non *Biddulphia punctata* GREV. 1864.

Very rare: Gaukværø, rr. Irregularly punctate with puncta very different in size, shape and distance from each other, on an average 5 on 10 μ. Side of the triangle 40 μ.
Distribution: Tropical coasts of America, Africa and Asia. The nearly related *B. sculpta* (SHADB.) V. H., which by DE TONI l. c. p. 944 is considered to belong to the same species, occurs in Western Europe, the Skagerack, and the Mediterranean.

B. nobilis (WITT.).
Triceratium n. WITT. Diat. Simbirsk 1885, p. 34, pl. 10, f. 3; pl. 11, figs. 4, 7. A. SCHMIDT Atlas pl. 150, f. 25. Non *Biddulphia nobilis* BRUN 1889.

A specimen very similar to the figure referred to in SCHMIDT's Atlas (from Archangel) was found: Gaukværø r r; Stene r r. Large puncta, irregular in size and shape, intermingled with minute ones. Near the margin, larger areoles. In the centre, a conspicuous inward pointing spine is found. Side of the triangle 56 μ.
A nearly related species is *Triceratium Heibergii* GRUN., V. H. Synops. pl. 112, figs. 9—11 (from Mors).
Distribution: Only known fossil from Simbirsk. Perhaps also fossil in my samples (as is probably also the case with some of the other species).

B. Weissei (GRUN.)?
Triceratium Weissei GRUN. in A. SCHMIDT Atlas pl. 95, f. 2.

A specimen very similar to the figure referred to (from Archangel) was found: Stene, r r (a single specimen). Rather coarse radiating structure of puncta (pearls); about 6 rows on 10 μ. Large circular central space without puncta, only one or two near the periphery. Side of the triangle 57 μ.

Might also belong to the genus *Trinacria.* I have not seen a side view of the valve.

Distribution: Only known fossil (Simbirsk, Archangel).

Isthmia Ag.

I. enervis EHRB.
EHRB. Inf. p. 209, pl. 16, f. 6. VAN HEURCK Synops. pl. 96, figs. 1—3.

Rather frequent: Moskenstrømmen rr, Stamsund r, Svolvær r, Raftsund r, Brettesnes—Skroven r, Stene r. More frequent on algæ.

Distribution: Coast of Western Europe. Finmark; Spitsbergen (CLEVE). West Indies; Honduras.

I. nervosa KÜTZ.
KÜTZ. Bacill. p. 137, pl. 19, f. 5. VAN HEURCK Traité d. Diat. 452, pl. 34, f. 891.

Very rare: Raftsund r.

Distribution: Western Europe. Denmark. Arctic regions. Honduras; San Francisko. Kerguelen.

6. *Chætocereæ.*

Bacteriastrum *varians* LAUD.
LAUD. Trans. Micr. Soc. 1863, XII, p. 8, pl. III, figs. 1—6.

Derived from the plankton.

Very rare: Stene r r.

Distribution: Neritic plankton species, from the western coasts of Europe. Warmer coasts of the Atlantic, Indian and Pacific Oceans. Rare off the west coast of Norway.

Chætoceros Ehrb.

C. atlanticus CL.

Cf. above p. 100.
Derived from the plankton.
Very rare: Gaukværø r.

C. contortus SCHÜTT.

Cf. above p. 101.

Thickened horns, most probably belonging to this species, is found now and then in the bottom samples, though seldom. Undoubtedly derived from the plankton.

C. diadema (EHRB.) SCHÜTT.

The characteristic resting spores of this species (*Syndendrium diadema* EHRB.) occur rarely:

Stamsund r, Svolvær r, Gaukværø r. Derived from the plankton.

Distribution: Cfr. above p. 101. *Syndendrium diadema* EHRB. also in Peru guano.

Stephanogonia EHRB.

A specimen very similar to *S. actinoptychus* (EHRB.) GRUN. in VAN HEURCK Synops. p. 83₃, figs. 2—4 was found in the sample from Moskenstrømmen.

Nearly circular. Diameter 70 μ. 15 radii. On the smaller upper disc, a coarse spine seems to be found. In other respects corresponds very well to the figure referred to.

Stephanogonia polygona EHRB. seems to be a similar form, perhaps the same. Both are probably resting spores (cfr. SCHÜTT in ENGLER and PRANTL, Natürl. Pflanzenf., Th. 1, Abth. 1 b, p. 147).

Distribution: Both species mentioned are known from „North America“ (Ehrenberg). The figure mentioned represents a fossil specimen from Nottingham deposit.

Pyxilla baltica GRUN.
A. SCHM. Nords. Diat. pl. 3, f. 25. VAN HEURCK Synops. pl. 83, f. 2.

According to the figure in HENSEN (5ter Ber. Komm. Kiel, pl. V, f. 38 c) *Pyxilla baltica* must be the resting spore (endocyst) of *Rhizosolenia setigera* BRIGHTW.

Undoubtedly derived from the plankton.

Very rare: *Rhizosolenia setigera* is a neritic plankton diatom from the coasts of Europe (Western E., Skagerak, Mediterranean). Pacific Ocean, Indian Ocean; north of South America. *Pyxilla baltica* is known from the Baltic, and fossil from Simbirsk.

II. Pennatæ Schütt.

7. *Synedreæ.*

Synedra.

a. ***Eusynedra*** V. H.

S. affinis KÜTZ.
KÜTZ. Bacill., p. 68, pl. 15, figs. 6, 11. VAN HEURCK Synops. pl. 41, f. 13.

var. tabulata (KÜTZ.) V. H.
V. H. Synops. pl. 41, f. 9 a. *Synedra t.* KÜTZ.

Very rare: Svolvær r, Østnesfiord r.

Distribution: Frequent on the coasts of Europe. Arctic regions.

S. kamtschatica GRUN.
GRUN. in CL. et GRUN. Arkt. Diat. p. 106, pl. VI.

var. intermedia GRUN. l. c. f. 111.

Very rare: Stamsund r.

Distribution: Kamtschatka, Finmark, Spitsbergen, Greenland, Kara Sea, East Cape.

S. ulna (NITZSCH.) EHRB.
Van HEURCK Synopsis pl. 38, f. 7.

Fresh water species.

Very rare: Svolvær r.

Distribution: Common fresh water species.

b. ***Ardissonia*** (De Not.) V. H.

S. crystallina (Ag.) Kütz.

Kütz. Bacill. p. 69, pl. 16, f. I. Van Heurck Synops. pl. 42, f. 10. *Diatoma c.* Ag. Consp., p. 52.

Not unfrequent: Stamsund r, Svolvær +, Gaukværø r, Stene r.

Distribution: Coasts of Western Europe. The Mediterranean. Finmark.

S. superba Kütz.

Kütz. Bacill. p. 69, pl. 15, f. 13. Van Heurck Traité d. Diat., p. 316, pl. 30, f. 834.

Very rare: Østnesfiord r, Stene r.

Distribution: Coasts of Western Europe. The Mediterranean. Finmark (*var. minor* Grun.).

S. baculus Greg.

Greg. Trans. Micr. Soc. 1867, p. 88, pl. 1, f. 54. Van Heurck Synopsis pl. 42, f. 9.

Very rare: Svolvær r.

Distribution: Coasts of Scotland and Ireland.

c. ***Toxarium*** (Bail.) V. H.

S. undulata (Bail.) W. Sm.

W. Sm. Brit Diat. II, p. 97. Van Heurck Synops. p. 154, pl. 42, f. 2. *Toxarium undulatum* Bail. Notes on new sp. and loc. of Micr. Org. p. 15, figs. 24—25.

Not unfrequent: Stamsund r, Svolvær +, Østnesfiord r +, Gaukværø r.

Distribution: Coasts of Europe and North America. Red Sea.

S. Hennedyana Greg.

Greg. Diat. of Clyde p. 552, pl. XIV, f. 108. Van Heurck Synops. pl. 42, f. 3.

Very rare: Stamsund r. 400 μ long.

Distribution: Coasts of Scotland and Belgium. The Mediterranean.

S. (hyperborea var.?) rostellata Grun.

Grun. Diat. Franz Jos. Land p. 54, pl. II, figs. 6 a—b.

A specimen very similar to the figure referred to was found: Gaukværø. 38 μ × 3 μ. Striæ very fine.

Distribution: Franz Josef's Land.

Thalassiothrix *nitzschioides* Grun.

Cf. above p. 102.

Derived from the plankton.

Very rare: Stamsund r, Gaukværø r.

Distribution: Cf. above p. 102.

Sceptroneis Ehrb.

S. marina (Greg.) Grun.

Grun. in Van Heurck Synops., pl. 37, f. 2. *Meridion marinum* Greg. Diat. of Clyde p. 497, pl. X, f. 41.

Not unfrequent: Stamsund r +, Raftsund r, Østnesfiord r, Gaukværø r, Stene r.

Distribution: Coasts of the North Sea. Finmark. Balearic Isles.

S. kamtschatica Grun.?

Grun. in Van Heurck Synops. pl. 37, f. 6.

A species very similar to the figure mentioned occurred in the sample from Stene, r (several specimens). Usually broader than the preceding, somewhat variable in shape, at the broader end sometimes rounded, sometimes only obtuse. Valve distinctly costate with linear pseudoraphe; costæ somewhat radiating, 6—6$^1/_2$ on 10 μ. Length 38—40 μ, breadth 7—8 μ. Also similar to *Opephora pacifica* Grun. in V.H. Synops. pl. 44, f. 22.

Distribution: Kamtschatka. *Opephora pacifica*, perhaps the same species, in the North Pacific.

Rhaphoneis Ehrb.

R. nitida (Greg.) Grun.

Cocconeis n. Greg. Diat. of Clyde. p. 492, pl. IX, f. 26. Grun. Alg. Novara p. 99.

Rare: Stamsund r +.

Distribution: Coasts of the North Sea. The Mediterranean. Auckland.

8. *Plagiogrammeæ.*

Plagiogramma *staurophorum* (Greg.) Heib.

Heib. Consp. Diat. Dan. p. 55. *P. Gregorianum* Grev., Van Heurck Synops. p. 145, pl. 36, f. 2. *Denticula staurophora* Greg. Diat. of Clyde p. 496, pl. X, f. 37.

Frequent: Stamsund r, Svolvær r, Raftsund r, Østnesfiord r, Gaukværø +, Stene +.

Distribution: Coasts of the North Sea and Western Europe. Finmark; Greenland. South America. Ceylon.

Dimeregramma Ralfs.

D. minus (Greg.) Ralfs.

Ralfs in Pritch. Inf. p. 790. Van Heurck Synops. pl. 36, f. 10, 11 a. *Denticula m.* Greg. Diat. of Clyde p. 496, pl. X, f. 35.

Somewhat rare: Stamsund r, Svolvær r, Gaukværø r, Stene r +.

var. nana (Greg.) V.H.

Van Heurck Traité p. 336, pl. 10, f. 393. *Denticula nana* Greg. l. c. f. 34.

Rare: Gaukværø r. Seems to be only a smaller form of the preceding species.

Distribution: Coasts of Western Europe. The Mediterranean.

D. fulvum (Greg.) Ralfs.

Ralfs l. c. *Denticula fulva* Greg. Diat. of Clyde, p. 496, pl. X, f. 38. Van Heurck Synops. pl. 36, f. 28.

Somewhat rare: Stamsund +, Gaukværø +, Stene r.

Distribution: Coasts of Western Europe. Sweden. The Mediterranean.

Glyphodesmis Grev.

G. Williamsonii (Greg.) Grun.

Cf. above p. 102.

Rather frequent: Moskenstrømmen r, Stamsund + c, Gaukværø r, Stene r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean.

G. distans (GREG.) GRUN.
GRUN. in VAN HEURCK Synops. pl. 36, figs. 15—16. *Denticula d.* GREG. Diat. of Clyde p. 495, pl. X, f. 36.

Very rare: Stene r; Stamsund r.
Distribution: Coasts of Western Europe. Sweden. The Mediterranean.

9. *Eunotieæ.*

Eunotia EHRB.

Fresh water species.

E. arcus EHRB.
VAN HEURCK Synops. p. 141, pl. 34, f. 2.

Very rare: Stene r.
Distribution: Common fresh water species.

E. major (W. SM.) RABENH.
VAN HEURCK Synops. p. 142, pl. 34, f. 14.

Very rare: Østnesfiord r.
Distribution: Fresh water species from Western Europe.

E. pectinalis (DILLW.?) RABENH.
VAN HEURCK Synops. p. 142, pl. 33, figs. 15—16.

Very rare: Svolvær r, Gaukværø r.
Distribution: Common fresh water species.

E. prærupta EHRB.
VAN HEURCK Synops. p. 143, pl. 34, f. 19.

Very rare: Østnesfiord r, Stene r.
Distribution: Northern Europe. America.

E. bidentula W. SM.
W. SM. Brit. Diat. II, p. 83.

Very rare: Gaukværø r r; Stamsund r r.
Distribution: Great Britain and Ireland.

E. triodon EHRB.
W. SM. Brit. Diat. I, p. 16, pl. 2, f. 18. VAN HEURCK Synops. pl. 33, f. 9.

Very rare: Gaukværø r; Stene r.
Distribution: Northern Europe. Switzerland. Cayenne.

***Ceratoneis** arcus* (EHRB.) KÜTZ.
VAN HEURCK Traité d. Diat., p. 305, f. 69.

Fresh water species.
Very rare: Gaukværø, r.
Distribution: Common fresh water species, especially in alpine localities.

10. *Meridioneæ.*

***Meridion** circulare* (GREV.) AG.
VAN HEURCK Synops. p. 161, pl. 51, figs. 10—12.

Fresh water species.
Very rare: Svolvær. Only two cells of a chain.
Distribution: Common fresh water species in temperate regions.

11. *Tabellarieæ.*

***Tabellaria** flocculosa* (ROTH) KÜTZ.
VAN HEURCK Synops. p. 162, pl. 52, figs. 10—12.

Fresh water species.
Rare: Svolvær r, Gaukværø r, Stene r.
Distribution: Common fresh water species.

***Striatella** unipunctata* (LYNGB.) AG.

Cf. above p. 103.
Very rare: Gaukværø r.
Distribution: Frequent on the coasts of Europe. Finmark. The Red Sea. Cape Horn.

Rhabdonema KÜTZ.

R. minutum KÜTZ.
KÜTZ. Bacill. p. 126, pl. 21, f. II, 4. VAN HEURCK Synops. p. 166, pl. 54, figs. 17—21.

Frequent: Stamsund r, Svolvær c, Raftsund r, Gaukværø r, Stene +.
Distribution: Frequent on the coasts of Europe, especially on the western and northern ones. Arctic regions. Cape of Good Hope.

R. arcuatum (LYNGB.) KÜTZ.
KÜTZ. l. c. p. 126, pl. 18, f. VI. VAN HEURCK Synops. p. 166, pl. 54, figs. 14—16. *Diatoma a.* LYNGB. Hydroph. p. 180, pl. 62.

Frequent: Svolvær + c, Raftsund r, Gaukværø r, Stene r +.
Distribution: Frequent on the coasts of Europe and North America. Arctic regions.

R. adriaticum KÜTZ.
KÜTZ. Bacill. p. 126, pl. 18, f. 7. VAN HEURCK Synops. p. 166, pl. 54, figs. 11—13. *Tessella catena* EHRB. Mikrogeol. pl. 22. f. 65.

Rare: Svolvær r, Raftsund r r, Stene r r.
Distribution: Frequent on the coasts of Europe and America. Finmark (r r CLEVE who remarks (Vegaexped. p. 484) that this species else is wanting in the arctic regions). Africa. Pacific Ocean.

Grammatophora EHRB.

G. islandica EHRB.
VAN HEURCK Synops. pl. 53. f. 7.

Not unfrequent: Stamsund r, Svolvær r, Raftsund r, Brettesnes—Skroven r, Stene r +.
Distribution: Northern and western coasts of Europe. North Pacific. Cape Horn.

G. serpentina RALFS.
RALFS in Ann. and Mag. XI, pl. IX f. 5. VAN HEURCK Synops. pl. 53, figs. 1—3.

Frequent: Moskenstrømmen r +, Stamsund r, Svolvær r, Raftsund r +, Brettesnes—Skroven r, Gaukværø r, Stene r.
Distribution: Frequent on the coasts of Europe. Ceylon. Cape Horn. Antarctic regions.

G. marina (LYNGB.) KÜTZ.

KÜTZ. Bacill. p. 128, pl. 17, f. XXIV, 1—6. VAN HEURCK Synops. p. 163, pl. 53, figs. 10—11. *Diatoma m.* LYNGB. Hydroph. p. 180, pl. 62 A.

Rare: Stamsund r.

Distribution: Frequent on the coasts of Europe. Africa. America. Ceylon.

G. oceanica EHRB.

EHRB. Mikrogeol. pl. 19, f. 36 a, pl. 18, f. 87 a.

Perhaps ought to be united with the preceding species.

Frequent: Stamsund r +, Svolvær + c, Østnesfiord r +, Gaukværø r, Stene r.

var. macilenta (W. SM.) GRUN.

GRUN. in Wien Verh. 1862. VAN HEURCK pl. 53, 2, f. 16. *G. macilenta* W. SM. Brit. Diat. II, p. 43, pl. 61, f. 382.

Svolvær +, Stene r.

Distribution: Frequent on the coasts of Europe. Greenland. Cape Horn. Indian Ocean.

G. arctica CL.

CL. Diat. Spitsb. 1867, p. 664, pl. 23, f. 1. VAN HEURCK Synops. pl. 53, 2, f. 3. *G. africana* EHRB. Mikrogeol. pl. 35 A, XX, figs. 1—2, (non l. c. pl. 18, f. 86 a, b).

Very rare: Stene r r.

Distribution: Arctic regions.

12. Nitzschieæ.

Bacillaria socialis GREG.

Cf. above p. 103.

Not unfrequent: Stamsund +, The Østnes Fiord r, Gaukværø r.

Distribution: Coast of Western and Northern Europe. Arctic regions. West Indies.

Nitzschia HASS.

a. **Panduriformis** GRUN.

N. panduriformis GREG.

GREG. Diat. of Clyde p. 529, pl. XIV, f. 102. VAN HEURCK Synops. p. 172, pl. 58, figs. 1—3.

Rare: Svolvær r, Stene r.

Distribution: Western coasts of Europe. Baltic. Adriatic Sea. Finmark. Spitsbergen. Indian Ocean. The Red Sea. Cape Horn.

N. constricta (Greg.) GRUN.

GRUN. in CL. et GRUN. Arct. Diat. 1880, p. 71. *Tryblionella c.* GREG. Micr. Journ. III, p. 40, pl. 1, f. 18.

Rare: Stamsund r, Svolvær r, Gaukværø r.

Distribution: Western Europe. The Mediterranean. Cape of Good Hope. Cape Horn. Ceylon.

b. **Tryblionella** (W. SM.) Grun.

N. navicularis (BRÉB.) GRUN.

GRUN. in CL. and GRUN. Arct. Diat. p. 67. VAN HEURCK Synops. p. 171, pl. 57, f. 1. *Surirella navicularis* BRÉB. in KÜTZ. Spec. Alg. p. 36.

Very rare: Stene r.

Distribution: Coasts of the North Sea and Western Europe. Spitsbergen (uncertain, CL.)

N. punctata (W. SM.) GRUN.

GRUN. in CL. et GRUN. Arct. Diat. p. 69. VAN HEURCK Synops. p. 171, pl. 57, f. 2. *Tryblionella p.* W. SM. Brit. Diat. I, p. 36, pl. X, f. 76 a.

Rare: Stamsund r, Svolvær r, Stene r.

Distribution: Coasts of the North Sea and of Western Europe. The Baltic. The Mediterranean.

N. coarctata Grun.

GRUN. l. c. p. 68. VAN HEURCK Synops. pl. 57, f. 4.

Several specimens which seem to belong here were found: Gaukværø r.

Distribution: The Mediterranean; Japan; Cape Horn.

N. (Tryblionella var.?) litoralis GRUN.

GRUN. in CL. and GRUN. Arct. Diat. p. 75. VAN HEURCK Synops. p. 172, pl. 59 figs. 1—3.

Very rare: Stamsund r.

Distribution: Frequent in fresh and brackish water.

c. **Apiculatæ** GRUN.

N. apiculata (GREG.) GRUN.

GRUN. in CL. et GRUN. Arct. Diat. p. 73. *Tryblionella a.* GREG. Micr. Journ. V, p. 79, pl. 1, f. 43.

Very rare: Svolvær, r.

Distribution: Coasts of the North Sea and Western Europe. Finmark. Greenland.

N. acuminata (W. SM.) GRUN.

GRUN. in CL. et GRUN. Arct. Diat. p. 73. VAN HEURCK Synops., p. 173, pl. 58, figs. 16—17. *Tryblionella a.* W. SM. Brit. Diat. I, p. 36, pl. 10, f. 77.

Rare: Svolvær r, Stene r.

Distribution: Coasts of England. The Mediterranean.

N. marginulata GRUN.

GRUN. l. c. p.72.

var.? didyma GRUN. l. c.

VAN HEURCK Synops. pl. 58, figs. 14—15.

Rare: Stamsund r, Svolvær r.

Distribution: Frequent on the coasts of Europe. Arctic regions. Indian Ocean. Pacific Ocean.

N. hungarica GRUN.

GRUN. in Wien Verh. 1862, p. 568, pl. 22, f. 13. VAN HEURCK Synops. p. 173, pl. 58, f. 19.

Species from brackish water.

Very rare: Svolvær, r.

Distribution: Frequent in fresh and brackish water.

d. ***Dubiæ*** Grun.

N. littorea Grun. (?)
Van Heurck Synops. pl. 59, f. 21. *N. thermalis v. littoralis* Grun. in Cl. et Grun. Arct. Diat. p. 78.

Very rare: Stamsund r. 113 μ long; 7 keel puncta on 10 μ. Similar to *N. hybrida*, but is longer and narrower, with more distant keel puncta and more excentric keel. Also Stene, r r.
Distribution: Newcastle. Lysekil (Sweden).

e. ***Bilobatæ*** Grun.

N. bilobata W. Sm.
W. Sm. Brit. Diat. I, p. 42, pl. 15, f. 113. Van Heurck Synops. p. 175, pl. 60, f. 1.

Very rare: Østnesfiord, r.
Distribution: Frequent on the coasts of Europe (the most northern ones excepted). Pacific Ocean.

N. hybrida Grun.

Cf. above p. 103.
Perhaps derived from the plankton.
Very rare: Stamsund r.
Distribution: Cf. above p. 103.

N. Mitchelliana Greenl.

Cf. above p. 104.
Very rare: Østnesfiord r, Stene r.
Distribution: North America. Arctic regions.

f. ***Insignes*** Grun.

N. insignis Greg.
Greg. Micr. Journ. V, p. 80, pl. 1, f. 46.

Not unfrequent: Stamsund r, Østnesfiord r, Gaukværø r, Stene r.
Distribution: Coasts of Western and Northern Europe. Arctic regions. Adriatic Sea. Red Sea.

var. notabilis Grun.
Grun. in Cl. et Grun. Arct. Diat. p. 84. Van Heurck Synops. pl. 51, f. 5.

Very rare: Gaukværø r. 476 μ long; 9—10 striæ on 10 μ.
Distribution: The Mediterranean.

var. spathulifera Grun.
Van Heurck Synops. pl. 61, f. 3.

Very rare: Stamsund r.
Distribution: The Mediterranean. West Indies.

N. Smithii Ralfs.
Ralfs in Pritch. Inf. p. 781. Van Heurck Synops. pl. 61, f. 4.

Not unfrequent: Stamsund +, Stene r.
Distribution: Coasts of Western Europe. Adriatic Sea. Finmark (*var. marginifera* Grun.).

g. ***Spathulatæ*** Grun.

N. angularis W. Sm.
W. Sm. Brit. Diat. I, p. 40, pl. 13, f. 117. Van Heurck Synops. p. 177, pl. 62, figs. 11—14.

Rather frequent: Stamsund r, Svolvær +, Østnesfiord r, Gaukværø +.
Distribution: Frequent on the western and northern coasts of Europe. The Mediterranean. Arctic regions. Ceylon. Cape Horn.

N. spathulata Bréb.
Bréb. in W. Sm. Brit. Diat. I, p. 40, pl. 31, f. 268. Van Heurck Synops. p. 177, pl. 62, figs. 7—8.

Somewhat rare: Stamsund r, Østnesfiord, Gaukværø r.
Distribution: Frequent on the western and northern coasts of Europe. The Mediterranean. Arctic regions.

N. distans Greg.
Greg. Diat. of Clyde, p. 530, pl. XIV, f. 103. Van Heurck Synops. pl. 62, f. 10.

Rare: Stamsund r (several specimens); Østnesfiord r.
Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Australia. Baffin's Bay and Davis' Strait, Cape Wankarema (Cl., varieties).

h. ***Sigmata*** Grun.

N. sigma (Kütz.) W. Sm.
W. Sm. Brit. Diat. I, p. 39, pl. 13, f. 108. *Synedra s.* Kütz. Bacill. p. 67, pl. 30, f. 114.

Frequent: Stamsund +, Svolvær +, Østnesfiord +, Gaukværø r +, Stene r.
Distribution: Cosmopolitan.

i. ***Lanceolatæ*** Grun.

N. lanceolata W. Sm.
W. Sm. Brit. Diat. I, p. 40, pl. XIV, f. 118. Van Heurck Synops. p. 182, pl. 68, figs. 1—4.

I have two times seen the wavy longitudinal lines, described and illustrated by W. Smith. They were more distinct than the transverse striæ.
Very rare: Stamsund r, Gaukværø r, Stene r.
Distribution: Frequent on the coasts of Europe, the most northern ones only excepted. Indian Ocean.

k. ***Nitzchiella*** (Rabenh.) Grun.

N. longissima (Bréb.) Ralfs.

Cf. above p. 104.
Very rare: Gaukværø r.
Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. West Indies. Indian Ocean.

13. Surirelleæ.

Campylodiscus Ehrb.

C. decorus Bréb.

C. decorus Bréb. Diat. Cherb. p. 13, f. 2. Van Heurck Synops. pl. 75, f. 3.

Not unfrequent: Moskenstrømmen r, Stamsund r, Østnesfiord r, Gaukværø r.

Distribution (including the nearly related C. *Ralfsii* W. Sm.): Frequent on the coasts of Europe. Greenland. Java. Pacific Ocean.

C. Ralfsii W. Sm.

W. Sm. Brit. Diat. I, p. 30, pl. 30, f. 257. A. Schm. Atlas pl. 14, figs. 2—3.

Differs from the preceding species in having a linear (not lanceolate) pseudoraphe. Smaller in size.

Very rare: Stene r, Stamsund r.

C. angularis Greg.

Greg. Diat. of Clyde p. 502, pl. XI, f. 53. A. Schmidt Atlas pl. 18, f. 7.

Frequent: Raftsund r, Brettesnes—Skroven r, Østnesfiord c, Stene r.

Distribution: Scotland. The Skagerak. Arctic regions.

C. Thuretii Bréb.

Bréb. Diat. Cherb. pl. 1, f. 3. Van Heurck Synops. p. 190, pl. 77, f. 1.

Frequent: Moskenstrømmen r, Stamsund +, Svolvær r +, Raftsund r, Brettesnes—Skroven r, Østnesfiord + c, Gaukværø + c, Stene r +.

Distribution: Frequent on the coasts of Europe. Arctic regions. Indian Ocean.

C. parvulus W. Sm.

W. Sm. in Brit. Diat. I, p. 30, pl. 6, f. 56. Van Heurck Synops. p. 191, pl. 77, f. 2.

Is by some authors considered to be a form of C. *Thuretii* Bréb. (cf. De Toni Syll. p. 622) by others to belong to C. *decorus* Bréb. (cf. Van Heurck Traité p. 376).

Very rare: Stene r.

Distribution: England. Belgium.

C. eximius Greg.

Greg. Diat. of Clyde p. 503, pl. XI, f. 54.

Very rare: Stene r r. Only a broken valve.

Distribution: Coasts of Western Europe. The Mediterranean. Red Sea. Indian Ocean.

Surirella Turp.

S. gemma Ehrb.

Ehrb. Abh. Berl. Akad. 1840, p. 76, pl. IV, f. 5. Van Heurck Synops. p. 187, pl. 74, figs. 1—3.

Very rare: Gaukværø r r.

Distribution: Frequent on the coasts of Europe. Spitsbergen.

S. ovalis Bréb.

Kütz. Bacill. p. 61, pl. 30, f. 64. Van Heurck Synops. p. 188, pl. 73, f. 8.

In fresh and brackish water.

Very rare: Gaukværø r.

var. ovata (Kütz.) V. H.

VH. Synops. p. 188, pl. 73, figs. 6—7. *Surirella ovata* Kütz. l. c. p. 62, pl. 7, figs. 1—4.

Very rare: Gaukværø r.

Distribution: Common species.

S. fastuosa Ehrb.

Ehrb. Abh. Berl. Ak. 1841, p. 19. Van Heurck Synops. p. 188, pl. 73. f. 18.

Rather frequent: Svolvær +, Raftsund r, Gaukværø r, Stene r +.

var. lata (W. Sm.) VH

Van Heurck Synops. p. 188, pl. 72, f. 17. *Surirella l.* W. Sm. Brit. Diat. I, p. 31, pl. 9, f. 61.

Frequent: Moskenstrømmen r +, Stamsund r, Svolvær r, Raftsund r, Brettesnes—Skroven r, Østnesfiord r, Gaukværø r, Stene r.

Distribution: Frequent on the coasts of Europe. Gulf of Mexico.

14. Achnantheæ Cl.

Achnanthes Bory.

A. longipes Ag.

Ag. Syst. p. 1. Van Heurck Synops. p. 129, pl. 26, figs. 13—16.

Very rare: Svolvær r.

Distribution: Frequent (on algæ) on the coasts of Europe. The Canary Isles.

A. brevipes Ag.

Ag. l. c. Van Heurck Synops. p. 129, pl. 26, figs. 10—12.

Rare: Stamsund r, Stene r, Østnesfiord r.

Distribution: Frequent on the coasts of Europe.

Eucocconeis Cl.

Valves ecostate, without marginal loculiferous rim. Both valves with narrow axial area, rather similar in structure.

E. pseudomarginata (Greg.) Cl.

Cl. Synops. Navic. Diat. II, p. 178. *Cocconeis p.* Greg. Diat. of Clyde p. 497, pl. IX, f. 27. *C. major* Greg. l. c. f. 28.

Rare: Stamsund r, Raftsund r, Østnesfiord r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Red Sea. Indian Ocean. Galapagos Islands. Honduras.

Heteroneis Cl. (includ. *Disconeis* Cl. l. c. p. 180 and *Actinoneis* Cl. l. c. p. 185).

Valves very dissimilar, without marginal loculiferous rim. Upper valve costate, sometimes only striate, then with broad axial area.

H. Allmanniana (Greg.).

Pinnularia A. Greg. Diat. of Clyde p. 488, pl. IX, f. 21. *Cocconeis quarnerensis* A. Schm. Nords. Diat. pl. III, f. 16; Atlas pl. 192, figs. 20—24. *Rhaphoneis q.* Grun. Wien Verh. 1862, p. 381, pl. 7, f. 24. *Navicula ovulum* A. Schm. Nords. Diat. pl. II, f. 12. *Heteroneis q.* Cl. l. c. p. 184.

„Costæ apparently marginal, strong, about 20 in 0.001″, giving the appearance of a narrow marginal band of very strong costæ. Within this band, however, the valve, on close inspection, is found to be marked with similar but much fainter costæ nearly to the median line. The valve appears to be thicker near the margin than in the middle, and this perhaps is the reason why the costæ are so strong and conspicuous there.“ Greg. l. c.

It seems to me that there can scarcely be any doubt that *Pinnularia Allmanniana* Greg. is synonymous to *Cocconeis quarnerensis* Grun. Size, shape and structure agree very well in both species.

There seems to be a marginal rim which has, however, only faint traces of loculi.

Rare: Stamsund r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean.

H. norvegica (Grun.?)

Cocconeis norvegica Grun., Cl. Møll. Diat. no. 102 (upper valve, teste Cl.) A. Schm. Nords. Diat. pl. III ,f. 18, 1 (upper figure, „*Cocconeis sp.*“, upper valve).

Upper valve as illustrated l. c. by A. Schmidt. Instead of the median line (pseudoraphe), there is often a linear blank space, which sometimes (but rarely) is somewhat irregularly widened. The lower valve has a very delicate structure, consisting of close, somewhat radiating striæ, in the median part of the valve coarser and more conspicuous, about 15 on 10 μ, otherwise very faint, about 20 on 10 μ. Raphe strait, extending to the margin; the inner ends somewhat thickened, separated from each other. A rather broad hyaline border, but no loculiferous rim.

Cl. Synops. Navic. Diat. II, p. 180 mentions that he has found a frustule of *Cocconeis lyra* with an upper valve like that illustrated by A. Schm. l. c. (pl. III, f. 18, 1, upper figure). I have, however, found a frustule, showing this upper valve, in connection with a lower valve of the structure just described. There must therefore here be some mistake, if there are not two different species, with very similar upper valves.

There is a marginal rim, like a somewhat broad hyaline border, with only faint traces of loculi.

Rare: Stamsund r + (many specimens); Stene r.

Distribution: West coast of Norway (Solsvik near Bergen).

Cocconeis Ehrb., Cl.

Valves ecostate, with a marginal loculiferous rim, dissimilar in structure.

C. scutellum Ehrb.

Ehrb. Infus. p. 194, pl. 14, f. 8. Van Heurck Synops. p. 132, pl. 29, figs. 1—3.

According to Cleve exceedingly variable. It seems, however, that he has gone too far when referring so many different forms to this species, as he has done (l. c. pp. 170—171).

Not unfrequent, in different forms which only badly answer to the varieties described: Stamsund r, Svolvær +, Ostnesfiord r, Stene r.

Distribution: Cosmopolitan.

C. distans Greg., A. Schm.

Greg. Diat. of Clyde, p. 490, pl. IX, f. 23 (1857, non Micr. Journ. III, p. 39, pl. IV, f. 9, 1855 which Greg. l. c. p. 491 himself declares to be a var. of *C. scutellum* illustrated as *C. distans* by mistake). A. Schm. Nords. Diat. pl. III, figs. 22—23 (*forma minima* Perag.).

Small specimens, very well answering to the figures in A. Schm. l. c. (f. 23 entire frustule) occurred. They had no loculiferous rim, only a hyaline border. Lower valve with very faint and indistinct striæ.

There is, however, such a remarkable agreement with a form of *C. scutellum*, most probably the one, mentioned above, which at first was figured by Gregory as *C. distans*, that I do not feel quite sure if not these two forms after all belong together. The only difference seems to be the larger marginal areoles which are wanting in the true *C. distans*.

The variety of *C. scutellum* just mentioned differs remarkably from the common forms. There is a narrow marginal rim, but no loculi. Lower valve with straight raphe, stretching to the margin. Median pores somewhat separated from each other. Axial area indistinct except towards the central nodule, where it suddenly dilates into a small, round, central one. Striæ finely radiating, much curved towards the ends of the valve, most conspicuous near the margin, distinctly punctate, about 14 on 10 μ. A narrow striate border with striæ somewhat closer and less conspicuous than the marginal striæ of the valve, 15—16 one 10 μ. 38 μ × 29 μ.

Smaller specimens seem to pass insensibly into such forms, which A. Schm. has figured l. c.

Very rare: Stamsund r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Central and Arctic America. Sea of Kara.

C. lyra A. Schm.

A. Schm. Nords. Diat. pl. III, f. 19 (right figure lower valve, left figure upper valve).

As mentioned above I think there must be some mistake, when Cl. mentions having seen a frustule of this species with the upper valve of the species above named *Heteroneis norvegica*. Though I have seen no entire frustule of *C. lyra*, I should think that A. Schm.'s illustrations to which I have referred, belong together, which also answers very well to the dimensions. I have repeatedly found this upper valve in connection with a loculiferous rim with 6 loculi on 10 μ. The species consequently is no *Disconeis* Cl., but belongs to *Cocconeis* or *Pleuroneis*.

The remarkable lower valve occurred sparsely in my material, but corresponded in size and shape precisely to the supposed upper valve. Its structure is puzzlingly similar to that of small forms of *Navicula lyra var. atlantica*. On one side of the valve between the furrows and the margin, there is, however, an indistinct blank line or furrow, parallel to the main furrows, which is absent in the *Navicula* mentioned.

Upper valve with transverse and longitudinal costæ, the latter a little closer than the former. Between the costæ there is, therefore, a single row of conspicuous areolæ.

Rare: Stamsund r (both valves); Stene r (upper valve only).

Distribution: West coast of Norway.

Pleuroneis CL. l. c. p. 181.

Marginal loculiferous rim. Upper valve costate. Between the costæ double rows of small pearls.

P. costata (GREG.) CL. l. c.
Cocconeis c. GREG. in Q. M. J. III, 1855, p. 39, pl. 4, f. 10. VAN HEURCK Synops. pl. 30, figs. 11—12.

Has a broad and well developed loculiferous rim.
Rare: Stamsund r, Østnesfiord r, Stene r.
Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Canada. Auckland.

P. pinnata (GREG.)
Cocconeis p. GREG. Micr. Journ. VII, p. 79, pl. 6, f. 1. VAN HEURCK Synops. pl. 30, figs. 6—7.

Lower valve: The raphe fine, straight, stretching to the ends of the valve, in the middle with clavate ends, somewhat separated from each other. Axial area not visible, central one very small, roundish. Striæ very faint, not distinctly seen on my specimens. There is a marginal rim with rudimentary loculi which are less than half developed, but very well visible, 4 on 10 μ. A distinct hyaline border. This species seems on the whole to be closely related to *Pleuroneis costata* though undoubtedly a separate species.

P. britannica (NÆG.) CL.
CL. l. c. p. 181. *Cocconeis b.* KÜTZ. Sp. Alg. p. 890. VAN HEURCK Synops. pl. 30, figs. 1—2.

Very rare: Stamsund r r.
Distribution: England. The Mediterranean. The Barbadoes.

Rhoicosphenia GRUN.

R. curvata (KÜTZ.) GRUN.
GRUN. ALG. Novara p. 8. *Gomphonema c.* KÜTZ. 1833. *Gomphonema minutissima* EHRB. Mikrogeologie pl. 35 A, XII, f. 5, non *G. minutissima* GREV. (earlier name, = *G. exiguum* KÜTZ.).

In fresh or brackish water. A coarser form (var. *marina* VAN HEURCK Synops. pl. 26, f. 4) marine.
Very rare: Svolvær r, Østnesfiord r.
Distribution: Cosmopolitan in fresh and brackish water.

15. Gomphonemeæ.

Gomphonema AG.

G. constrictum EHRB.
EHRB. Abh. Berl. Ak. 1830. VAN HEURCK Synops. p. 123, pl. 23, f. 6.

Very rare: Svolvær r.
Distribution: Common fresh water species.

G. exiguum KÜTZ.
KÜTZ. Bacill. p. 84, pl. 30, f. 58.

var. pachyclada (BRÉB.) VH. Synops. pl. 25, figs. 31—32. *Gomphonema p.* BRÉB. Consid. p. 21.

Very rare: Stene r r.
Distribution: West coast of France. Arctic regions.

G. kamtschaticum GRUN.
GRUN. Casp. Sea Alg. p. 12. VAN HEURCK Synops. 25, f. 29.

Very rare: Svolvær, r r. Valve 45 × 8 μ, narrow, clavate, with rounded broader end. Axial area narrow, dilated to an oblong central area. Striæ little radiating, coarser outside the central area, about 15 on 10 μ, in the middle only 11.
Distribution: (Marine). Arctic America and Asia. Iceland.

16. Naviculeæ.

Auricula ***complexa*** (GREG.) DE T.
DE TONI Syll. p. 347. *Amphipora complexa* GREG. Diat. of Clyde p. 508, pl. XII, f. 62, VAN HEURCK Traité d. Diat. p. 267, pl. 29, f. 807.

Probably derived from the plankton.
Very rare: Østnesfiord r.
Distribution: Cf. above p. 108.

Tropidoneis CL.

T. maxima (GREG.) CL.
CL. Synops. Navic. Diat. I, p. 26. *Amphiprora m.* GREG. Diat. of Clyde p. 507 pl. XII, f. 61. VAN HEURCK Synops. p. 120, pl. 22, figs. 4—5.

Somewhat rare: Stamsund r, Svolvær r, the Østnesfiord r, Stene r +, Gaukværø r.
Distribution: Coasts of the North Sea and Ireland. The Mediterranean. Finmark (var. *dubia* CL. et GRUN.). Indian Ocean.

T. lepidoptera (GREG.) CL.
CL. l. c. p. 25. *Amphiprora l.* GREG. Diat. of Clyde p. 505, pl. XII, f. 59 a, b (non c). VAN HEURCK Synops. p. 120, pl. 22, figs. 2—3.

Not unfrequent: Stamsund +, Svolvær r, the Østnesfiord r, Stene r +, Gaukværø r.
Distribution: Coasts of the North Sea and Western Europe. Finmark. The Mediterranean. West Indies. Indian Ocean. Pacific Ocean.

Donkinia RALFS.

D. recta (DONK.) GRUN.
GRUN. in VAN HEURCK Synops. p. 119, pl. 17, f. 9. *Pleurosigma r.* DONK. Micr. Journ. VI, p. 23, pl. 3, f. 6. *Gyrosigma r.* CL. Synops. Navic. Diat. I, p. 119.

Very rare: Stamsund, r.
Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Florida. Pacific Ocean. Indian Ocean.

D. carinata (DONK.) RALFS.
RALFS in PRITCH. Inf. p. 921. VAN HEURCK Traité d. Diat. p. 248, pl. 35, f. 912. *Pleurosigma c.* DONK. Micr. Journ. VI, p. 23, pl. 3, f. 5; CL. l. c. p. 44.

Rare: The Østnesfiord r, Stene r, Gaukværø r.
Distribution: Coasts of the North Sea and Ireland. Sea of Kara. Davis' Strait. Balearic Islands.

Pleurosigma W. Sm.

a. ***Eupleurosigma.*** Striæ in three directions (transverse and oblique).

P. nubecula W. Sm.
W. Sm. Brit. Diat. 1, p. 64, pl. 21, f. 201.

var. subrecta Cl.
Cl. Synops. Navic. Diat. 1, p. 35. *Pleurosigma s.* Cl. in Cl. et Grun. Arct. Diat. p. 53. pl. 3, f. 72.

Very rare: Stamsund, r. 254 μ × 21 μ; oblique striæ 18 on 10 μ, angle more than 60°, transverse striæ indistinct. Raphe central, almost straight. Somewhat broader in the middle, with obtuse ends.
Distribution (of the variety): Finmark. Greenland. Sea of Kara. Balearic Islands.

P. elongatum W. Sm.
W. Sm. Brit. Diat. 1, pl. 20, f. 199. Peragallo Monogr. Pleuros. pl. 11, figs. 20—21.

Very rare: The Ostnesfiord r.
Distribution: Coasts of the North Sea and Ireland. Baltic. Arctic regions. The Mediterranean. Caspian Sea. North America, east coast. Pacific Ocean. Indian Ocean.

P. rigidum W. Sm.
W. Sm. Brit. Diat. I, p. 64, pl. 20, f. 198. Peragallo l. c. pl. VI, figs. 4—6.

Very rare: Stamsund r, Gaukværø r.
Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. West Indies. Straits of Magellan.

P. Normanni Ralfs.
Ralfs in Pritch. Inf. p. 919. *P. affine* Grun. in Cl. et Grun. Arct. Diat. p. 51. Van Heurck Synops. pl. 18, f. 9.

Frequent: Stamsund r, Svolvær c, the Ostnesfiord + c, Stene c, Gaukværø +.
Distribution: Coasts of the North Sea. The Mediterranean. Spitsbergen. Davis' Strait. East coast of North America. Pacific Ocean. The Red Sea.

P. strigosum W. Sm.
W. Sm. Brit. Diat. I, p. 64, pl. 21, f. 203; pl. 23, f. 203. Perag. l. c. pl. V, figs. 1—2.

Very rare: Stamsund r, Svolvær r.
Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Africa. America.

P. formosum W. Sm.
W. Sm. Brit. Diat. I, p. 63, pl. 20, f. 195. Van Heurck Synops. p. 116, pl. 19, f. 4.

Rare: Stamsund r, Stene r, Gaukværø r.
Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. The Red Sea. Indian Ocean. Pacific Ocean. West Indies.

P. speciosum W. Sm.
W. Sm. Brit. Diat. I, p. 63, pl. 20, f. 197. Perag. l. c. pl. II, figs. 13—16.

Very rare: Stene, r.
Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean. West Indies.

b. ***Gyrosigma*** (Hass.).

P. attenuatum (Kütz.) W. Sm.
W. Sm. Brit. Diat. I, p. 68, pl. 22, f. 216.

var. scalprum Gaill. et Turp.
Gaill. et Turp. Mem. du Mus. XV, pl. X, XI, f. 3. *P. acuminatum* W. Sm. Brit. Diat. I, p. 66, pl. 21, f. 209.

Very rare: The Ostnesfiord, r.
Distribution (of the variety): North Sea, brackish and marine.

P. balticum (Ehrb.) W. Sm.
W. Sm. Brit. Diat. I, p. 66, pl. 22, f. 207. *Navicula b.* Ehrb. Abh. Berl. Ak. 1830, p. 114.

Very rare: Stamsund r, Svolvær r r.
Distribution: Cosmopolitan in warm and temperate regions.

Rhoicosigma Grun., Per.

R. arcticum Cl.
Cl. Diat. Arct. Sea p. 18, pl. III, f. 16. Peragallo Mon. Pleur. pl. X, figs. 16—17. *Gyrosigma a.* Cl. Synops. Navic. Diat. I, p. 119.

Frequent: Stamsund r, the Ostnesfiord + c, Gaukværø c.
Distribution: Scotland. West coast of Norway, frequent. Arctic regions.

Scoliotropis Cl.

S. latestriata (Bréb.) Cl.
Cl. Synops. Navic. Diat. I, p. 72. *Amphiprora l.* Bréb. in Kütz. Sp. Alg. p. 93. *Scoliopleura l.* Grun. in Van Heurck Synops. pl. 17, f. 12.

Very rare: Stamsund r, Stene r.
Distribution: Coasts of the North Sea and Western Europe. Caspian Sea. East coast of North America. West Indies. California.

Scoliopleura *tumida* (Bréb.) Rabenh.

Rabenh. Fl. Eur. Alg. p. 229. Van Heurck Synops. p. 112, pl. 17, figs. 11, 13. *Navicula t.* Bréb. in Kütz. Sp. Alg. p. 77; Cl. l. c. p. 155.

Very rare: Gaukværø, r.
Distribution: Coasts of the North Sea and Western Europe. Franz Josef's Land. Black Sea. Ceylon. Sidney.

Pseudoamphiprora Cl.

Cl. Synops. of Navic. Diat. I, p. 71.

According to Cleve the following species has 2 chromatophores peculiar in shape and position.

P. stauroptera (Bail.) Cl.
Cl. l. c. *Amphora stauroptera* Bail. Smiths. Contrib. VII, p. 8, figs. 14—15. *Amphiprora obtusa* Greg. Diat. of Clyde p. 506, pl. XII, f. 60 and f. 59 c („*Amphiprora lepidoptera*" Greg., non f. 59 a, b.). A. Schm. Nords. Diat. pl. III, f. 1.

Very rare: Stamsund r, the Ostnesfiord r.
Distribution: North Sea. Finmark. Sea of Kara. Nova Scotia. Sidney. (Cl. l. c.).

Caloneis Cl.

Cl. Synops. Navic. Diat. I, p. 46.

Valve striate; striæ parallel, except at the ends, crossed on each side of the raphe by one or more longitudinal lines. Connecting zone not complex.

C. liber (W. Sm.) Cl.

Cl. l. c. p. 54. *Navicula l.* W. Sm. Brit. Diat. I. p. 48, pl. 16, f. 133.

var. linearis (Grun.) VH.

VH. Synops. pl. 12, f. 35. *Navicula l.* Grun. Verh. 1860, p. 546, pl. 3, f. 2.

Frequent: Stamsund +, Svolvær + c, the Østnesfiord r +, Raftsund r, Stene r +, Gaukværø +.
Distribution: Cosmopolitan.

var. maxima (Greg.)

Navicula m. Greg. Diat. of Clyde p. 487, pl. IX, f. 18. A. Schm. Nords. Diat. pl. II, f. 41.

Frequent: Stamsund + c, Stene r +.
Distribution: Coasts of the North Sea and Western Europe.

var. elongata (Grun.) Cl.

Cl. l. c. p. 55. *Navicula e.* Grun. in A. Schm. Nords. Diat. p. 91, pl. II, f. 42.

Very rare: Stamsund r.
Distribution: Coasts of the North Sea. Indian Ocean. Colon.

C. consimilis (A. Schm.) Cl.

Cl. l. c. p. 57. *Navicula c.* A. Schm. Nords. Diat. p. 91, pl. II, f. 46.

Very rare: Stamsund r.
Distribution: North Sea. Balearic Islands.

C. amphisbæna (Bory.) Cl.

Cl. l. c. p. 58. *Navicula a.* Bory Encycl. meth., t. 2. Van Heurck Synops. p. 102, pl. XI, f. 7.

Very rare: Stene, r.
Distribution: In brackish and fresh water, frequent especially in Northern and Western Europe. Caspian Sea.

C. brevis (Greg.) Cl.

Cl. l. c. p. 61. *Navicula b.* Greg. Diat. of Clyde, p. 478, pl. IX, f. 4. A. Schm. Nords. Diat. pl. II, f. 15.

Very rare: Stamsund r, the Østnesfiord r, Stene rr.
Distribution: North Sea. Arctic regions.

C. blanda (A. Schm.) Cl.

Cl. l. c. p. 62. *Navicula b.* A. Schm. Nords. Diat. p. 90, pl. II, f. 27.

Very rare: Stamsund rr, the Østnesfiord r.
Distribution: Coasts of the North Sea. Black Sea. Indian Ocean. Pacific Ocean.

C. musca (Greg.) Cl.

Cl. l. c. p. 65. *Navicula m.* Greg. Diat. of Clyde, p. 479, pl. IX, f. 6. A. Schm. Nords. Diat. p. 86, pl. I, f. 15.

Very rare: Stamsund r.
Distribution: Coasts of the North Sea. The Mediterranean. Indian and Pacific Oceans. West Indies.

Schizonema Ag.

S. Grevillei Ag.

Ag. Consp. p. 18. Van Heurck Synops. p. 110, pl. 16, f. 2.

Rare: Stamsund r, Svolvær r.
Distribution: Coasts of the North Sea and Western Europe, frequent. Arctic regions. West Indies. California. Kerguelen.

S. crucigerum W. Sm.

W. Sm. Brit. Diat. II, p. 74, pl. 56, fig. 354; pl. 57, f. 356. Van Heurck Synops. p. 110, pl. 16, f. 1.

Rare: Svolvær, r.
Distribution: Coasts of the North Sea and Western Europe. The Baltic.

Stauroneis Ehrb.

S. salina W. Sm.

W. Sm. Brit. Diat. I, p. 60, pl. 19, f. 188. Van Heurck Synops. p. 68, pl. X, f. 16.

Rare: Stamsund r, Stene r.
Distribution: Coasts of the North Sea. The Baltic. The Mediterranean. Black Sea.

S. Gregorii Ralfs.

Ralfs in Pritch. Inf. p. 913. Van Heurck Synops. p. 68, pl. A (suppl.), f. 4. *S. amphioxys* Greg. Micr. Journ. IV, p. 48, pl. V, f. 23.

Rare: Stamsund r, Gaukværø r.
Distribution: Coasts of the North Sea. Black Sea. Caspian Sea. East coast of North America. Sea of Kara.

S. phœnicenteron Ehrb.

Ehrb. Am. pl. II, 5, f. 1 etc. Van Heurck Synops. p. 67, pl. IV, f. 21 (*var. genuina* Cl. Synops. Navic. Diat. I, p. 149).

Very rare: Stene, r.
Distribution: Fresh water species, especially frequent in Northern and Western Europe. America. New Zealand.

Navicula Bory.

a. ***Orthostichæ*** Cl. Synops. Navic. Diat. I, p. 107.

Valves with small puncta, arranged in parallel transverse striæ and also forming straight longitudinal ones, crossing the former at right angles.

N. cuspidata Kütz.

Kütz. Bacill. p. 94, pl. III, figs. 24, 37. Van Heurck Synops. p. 100, pl. XII, f. 4.

Very rare: Stamsund r, the Østnesfiord r.
Distribution: Common fresh water species.

b. ***Punctatæ*** Cl. l. c. II, p. 37.

Coarse puncta, arranged in transverse striæ (radiate at the ends) but not in straight longitudinal rows.

N. humerosa Bréb.

Bréb. in W. Sm. Brit. Diat. II, p. 93. Van Heurck Synops. p. 98, pl. XI, f. 20.

Very rare: Raftsund r.

Distribution: Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean, Black Sea, Caspian Sea. The Red Sea; Indian Ocean. Sidney. Cameroon.

N. monilifera Cl.

Cl. l. c. p. 43. *N. granulata* Bréb. in Donk. Micr. Journ. VI, p. 17, pl. III, f. 19, non *N. granulata* Bail.

Very rare: The Østnesfiord r.

var. heterosticha Cl.

Cl. l. c. *N. granulata* A. Schm. Atlas, pl. 6, figs. 15—16.

Very rare: Raftsund, r.

Distribution (of the main species): North Sea. Ceylon. Madagascar. The var. only known from Hungary, fossil.

N. latissima Greg.

Greg. Micr. Journ. IV, p. 40, pl. V, figs. 4, 4*. A. Schm. Nords. Diat. pl. I, f. 30.

Frequent: Moskenstrømmen r +, Svolvær r, the Østnesfiord r, Raftsund r, Stene r +.

Distribution: Coasts of the North Sea. Finmark. The Mediterranean. Black Sea. Indian Ocean. Pacific Ocean.

N. punctulata W. Sm.

W. Sm. Brit. Diat. I, p. 52, pl. 16, f. 151. Van Heurck Synops. p. 98, pl. 11, f. 16.

Very rare: Stamsund r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Caspian Sea. America. Indian Ocean.

N. fraudulenta A. Schm.

A. Schm. Atlas pl. 70, f. 60; Nords. Diat. pl. III, f. 18_2 (without name).

Rare: Stamsund r +. Many specimens.

Distribution: North Sea. Sebastopol.

c. *Lineolatæ* Cl. l. c. II, p. 10.

Radiate or parallel striæ, transversely lineate.

N. radiosa Kütz.

Kütz. Bacill. p. 91, pl. IV, f. 23. Van Heurck Synops. p. 83, pl. 7, f. 20. Incl. *Pinnularia acuta* W. Sm. Brit. Diat. I, p. 56, pl. XVIII, f. 173.

Rare: Stene, r.

Distribution: Frequent fresh water species, especially in Northern and Western Europe. Asia, Africa, America.

N. peregrina Ehrb.

Ehrb. Am. p. 133, pl. 1_1, figs. 5—6. A. Schm. Atlas pl. 47, figs. 57—60.

Very rare: Gaukværø, r.

Distribution: Brackish water. Coasts of the North Sea. Baltic. Adriatic Sea. Arctic regions. America. Pacific Ocean. Indian Ocean.

var. kefwingensis (Ehrb.) Cl.

Cl. l. c. p. 18. *Pinnularia k.* Ehrb. Berl. Ak. 1840, p. 20. *Navicula k.* A. Schm. Atlas pl. 47, figs. 61—62.

Very rare: Svolvær. 141 μ long.

Distribution: Brackish water: Scotland.

N. digito-radiata (Greg.) A. Schm.

A. Schm. Nords. Diat. p. 92, pl. III, f. 4. *Pinnularia d.* Greg. Micr. Journ. IV, pl. I, f. 32.

Frequent: Stamsund +, Svolvær r, the Østnesfiord r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. Caspian Sea. New York.

N. directa W. Sm.

W. Sm. Brit. Diat. I, p. 56, pl. 18, f. 172. A. Schm. Atlas pl. 47, figs. 4—5 (*var. genuina* Cl. l. c. p. 27).

Rare: Stamsund r +, the Østnesfiord r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. Yokohama.

var. remota Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 39. A. Schm. Nords. Diat. pl. III, f. 2.

Somewhat rare: Stamsund +, the Østnesfiord r, Gaukværø r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Red Sea. Central America.

var. subtilis (Greg.) Cl.

Cl. Vega p. 467. *Pinnularia s.* Greg. Diat. of Clyde, p. 188, pl. IX, f. 19.

Rare: Stene r, Gaukværø r.

Distribution: Scotland. Arctic regions.

N. finmarchica (Cl. et Grun.) Cl.

Cl. l. c. p. 28. *Stauroneis f.* Cl. et Grun. Arct. Diat. p. 47, pl. III, f. 63.

Very rare: Stene, r r. Very similar to the figure quoted, though wanting the fainter or blank lateral areas. Also very similar to *N. transitans forma minuta* Cl. Vega pl. 36, f. 37.

N. frigida Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 39. Grun. Diat. Franz Jos. Land, p. 103, pl. 1, f. 25. *Navicula kariana v. frigida* Cl. l. c. p. 28.

Probably derived from the plankton.

Rare: Stamsund, r +.

Distribution: Arctic regions. Cf. above p. 105.

N. cancellata Donk.

Donk. Brit. Diat. p. 55, pl. 8, figs. 4 a, b. A. Schm. Nords. Diat. pl. II, figs. 36—37.

Very variable, probably also including *N. zostereti* and *N. northumbrica*.

Very frequent: Moskenstrømmen +, Stamsund +, Svolvær +, the Østnesfiord +, Raftsund r, Stene + c, Gaukværø c c.

Distribution: Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean. Indian Ocean. Pacific Ocean. Kerguelen.

var. Gregorii (Ralfs.) Grun.

Grun. in Cl. and Grun. Arct. Diat. p. 87. *Navicula Gregorii* Ralfs in Pritch. Inf. p. 901. A. Schm. Nords. Diat. pl. II, f. 22.

Very rare: Stamsund r, Gaukværø r.
Distribution: Coasts of the North Sea. Baltic. Arctic regions. Pacific Ocean. Kerguelen.

N. northumbrica Donk.

Donk. Micr. Journ. I, p. 9, pl. I, f. 5. A. Schm. Atlas pl. 47, figs. 19—20.

Very rare: Stamsund r, Stene r r.
Distribution: North Sea.

N. zosterett Grun. (?)

Gnun. in Wien. Verh. 1860 p. 528, pl. IV, f. 23. A. Schm. Atlas pl. 47, f. 43.

Rare: Stamsund r, Stene r, Gaukværø r.
Distribution: The Mediterranean. Indian Ocean. Pacific Ocean. Brazil.

N. fortis (Greg.) Donk.

Donk. Brit. Diat. p. 57, pl. 8, f. 8. *Pinnularia f.* Greg. Micr. Journ. IV, p. 47, pl. V, f. 19. A. Schm. Atlas pl. 46, figs. 37—39.

Perhaps only a coarse variety of *N. cancellata.*
Very rare: Stene, r.
Distribution: North Sea. Arctic regions (Spitsbergen, Finmark, Greenland).

N. rostellata (Greg.) A. Schm.

A. Schm. Nords. Diat., expl. ad pl. II („*N. rostellaria* Greg.?") *Pinnularia r.* Greg. Diat. of Clyde p. 488, pl. IX, f. 20.

Very rare: Stene, r. Probably the same species as the following one. There does, however, really exist a form answering to Gregory's figure, without a central transverse area.
Distribution: Coasts of the North Sea.

N. crucifera Grun.

A. Schm. Atlas pl. 46, figs. 50—53; Nords. Diat. pl. II, f. 31 („*rostellaria* Greg.?")

Must be reckoned as a variety to the preceding species (or vice versa).
Very rare: Stamsund r; Gaukværø r.
Distribution: Coasts of the North Sea. Baltic. The Mediterranean. Sumatra.

N. distans (W. Sm.) Cl.

Cl. l. c. p. 35. *Pinnularia d.* W. Sm. Brit. Diat. I, p. 56, pl. 18, f. 169.

Very rare: Raftsund r, Stene r.
Distribution: North Sea. Arctic regions.

N. compressicauda A. Schm.

A. Schm. Nords. Diat. p. 91, pl. II, f. 35; Atlas pl. 46, f. 62.

The peculiar aspect of the ends of the valve is due to the convexity. The valve is boatshaped with sharp stems, at the bottom of which the terminal nodules are situated. Thus they are rather distant from the very ends.
Rare: Stamsund r +.
Distribution: Coasts of the North Sea. Morocco. The Mediterranean.

N. superimposita A. Schm.

A. Schm. Nords. Diat. p. 90, pl. II, f. 34; Atlas pl. 46, f. 61.

In many respects answering to the preceding species, though undoubtedly distinct.
Very rare: Stamsund, r. Several specimens observed.
Distribution: West coast of Norway. Baltic. Morocco. China.

N. opima Grun.

N. fortis var.? opima Grun. Novara p. 100, pl. I A, f. 13. *N. opima* A. Schm. Atlas pl. 46, figs. 24—26.

Very rare: Stamsund, r.
Distribution: West coast of Norway. Baltic. Arctic regions. Barcelona.

d. ***Lævistriatæ*** Cl. l. c. p. 66.

Radiate striæ, not distinctly punctate nor lineolate. Valve more or less lanceolate.

N. palpebralis Bréb.

Bréb. in W. Sm. Brit. Diat. I, p. 50, pl. 31, f. 273. Van Heurck Synops. p. 96, pl. 11, f. 9.

Rare: Stamsund r +, Moskenstrømmen r, Gaukværø r.
Distribution: Coasts of the North Sea. The Mediteranean. East coast of North America. Davis' Strait. Galapagos Islands.

var. Barclayana (Greg.) VH.

VH. Synops. p. 97, pl. 11, f. 12. *Navicula B.* Greg. Diat. of Clyde p. 480. pl. IX, f. 9.

Rare: Stamsund, r.
Distribution: Coasts of the North Sea. The Mediterranean.

var. semiplena (Greg.) Cl.

Cl. l. c. p. 70. *Pinnularia s.* Greg. Micr. Journ. VII, p. 84, pl. VI, f. 12.

Rare: Stamsund, r.
Distribution: Scotland. Finmark. Spitsbergen.

var. angulosa (Greg.) VH.

Van Heurck Synops. pl. 11, f. 10. *Navicula a.* Greg. Micr. Journ. IV, p. 42, pl. V, f. 8. A. Schmidt Nords. Diat. pl. II, f. 19.

Rather frequent: Stamsund +, Stene r, Gaukværø r +.
Distribution: Coasts of the North Sea and Western Europe. The Mediterranean.

var. minor Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 30, pl. I, f. 23. *Navicula m.* Greg. Diat. of Clyde p. 477, pl. IX, f. 1.

Rare: Stamsund r, Gaukværø r.
Distribution: Finmark. Belgium.

N. præsecta A. Schm.

A. Schm. Nords. Diat. pl. II, f. 20.

Recalls the *var. semiplena* of the preceding species (cf. Cl. l. c. p. 70), but has a much finer structure. Striæ 15 on 10 μ. An obscure line is to be seen between the central area and the margin. Perhaps a species of *Caloneis.*

Very rare: Stamsund r. 53 μ long.
Distribution: West coast of Norway. Bohuslän (Sweden).

e. ***Lyratæ*** Cl. l. c. p. 52.

N. prætexta Ehrb.
Ehrb. 1840, Mikrogeolog. pl. 19, f. 28 *(Pinnularia p.).* Van Heurck Synops. p. 92, pl. IX, f. 13.

Not unfrequent: Moskenstrømmen +, Stamsund r, Svolvær r, Raftsund r, Stene r.
Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. Kerguelen. Cape Horn. America.

N. Hennedyi W. Sm.
W. Sm. Brit. Diat. II, p. 93. A. Schm. Nords. Diat. pl. I, f. 41.

Very variable.
Frequent: Stamsund c, the Østnesfiord r, Brettesnes—Skroven r, Raftsund +, Stene r +.
Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. Atlantic Ocean.

var. circumsecta Grun.
Grun. in A. Schm. Nords. Diat. p. 89, pl. I, figs. 36, 42 *(N. polysticta var. c.).*

Frequent: Stamsund + c, Raftsund r, Stene +.
Distribution: Coasts of the North Sea. Finmark. The Mediterranean. Red Sea. Indian Ocean. America.
Besides, a fine variety from Stamsund, r, with short marginal striæ between the main ones.

N. spectabilis Greg.
Greg. Diat. of Clyde p. 481, pl. IX, f. 10. A. Schm. Atlas, pl. 3, figs. 20—21.

Though usually easily recognizable, this species is scarcely distinct from all forms of the very variable *N. lyra* (cfr. Cl. l. c. p. 60).
Not unfrequent: Moskenstrømmen r +, Stamsund r +, Svolvær r, Raftsund r, Stene r +.
An analogous variety to that of *N. Hennedyi*, with more numerous marginal striæ, occurs (Stene, r).
Distribution: Coasts of the North Sea. Greenland. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. Cape Horn.

N. abrupta (Greg.) Donk.
Donk. Brit. Diat. p. 13, pl. II, f. 6. A. Schm. Nords. Diat. pl. I, f. 37. *N. lyra var. a.* Greg. Diat. of Clyde p. 486, pl. IX, figs. 14, 14 b.

Frequent: Moskenstrømmen r, Stamsund r, Svolvær + c, the Østnesfiord c, Raftsund r, Stene +, Gaukværø + c.
Distribution: Coasts of the North Sea. Finmark. Spitsbergen. The Mediterranean. Black Sea. Red Sea. Indian Ocean. China.

N. clavata Greg.
Greg. Micr. Journ. IV, p. 46, pl. V, f. 17. A. Schm. Nords. Diat. pl. I, f. 33.

Characteristic form, though hardly specifically different from certain varieties of *N. lyra.*
Not unfrequent: Moskenstrømmen r, Stamsund r, Svolvær r, the Østnesfiord r, Raftsund r +, Stene r.
Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. East coast of America.

N. lyra Ehrb.
Ehrb. Amer. p. 131, pl. I, I, f. 9. Van Heurck Synops. p. 93, pl. 10, f. 1. *N. lyra var. Ehrenbergii* Cl. l. c. p. 63.

Somewhat rare: Moskenstrømmen r, Stamsund r +, Svolvær +, the Østnesfiord r, Stene r.
Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. America.

var. elliptica A. Schm.
A. Schm. Nords. Diat. pl. I, f. 39. Van Heurck Synops. pl. 10, f. 2.

Very frequent: Stamsund +, Svolvær +, Raftsund +, Brettesnes—Skroven r, Stene c, Gaukværø +.
Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Philippines.

var atlantica A. Schm.
A. Schm. Nords. Diat. pl. I, f. 34.

Very characteristic. Recalls sometimes *N. abrupta*, but always easy to distinguish from that species.
Rare: Stamsund r +, Moskenstrømmen r.
Distribution: Coasts of the North Sea.

N. forcipata Grev.
Grev. in Micr. Journ. VII, p. 83, pl. VI, figs. 10—11. A. Schm. Nords. Diat. pl. I, f. 45; pl. II, figs. 16, 18.

Frequent: Stamsund c, Raftsund r, Stene r, Gaukværø + c.
Distribution: Coasts of the North Sea, frequent. Greenland. The Mediterranean. Black Sea. Red Sea. Cape of Good Hope. Indian Ocean. Pacific Ocean. Florida.

var. versicolor (Grun.) Grun.
Grun. in V. H. Synops. pl. X, f. 6. *Navicula v.* Grun. in A. Schm. Nords. Diat. pl. II, f. 17.

A very well marked variety.
Rare: Stamsund. +.
Distribution: North Sea. The Mediterranean. Sumatra.

N. pygmæa Kütz.
Kütz. Sp. Alg. p. 77. Van Heurck Synops. p. 94, pl. 10, f. 7.

It is hardly possible to keep this species distinct from certain varieties of the preceding species (cfr. Cl. l. c. p. 66).
Very rare: Stamsund r, Stene r.
Distribution: Brackish water: Coasts of the North Sea. Baltic. Arctic regions. America.

Pinnularia Ehrb.

a. ***Capitatæ*** Cl. Synops. Navic. Diat. II, p. 75.

P. microstauron Ehrb.
A. Schm. Atlas pl. 44, f. 16.

Very rare: Raftsund, r.
Distribution: Fresh water species. Arctic regions. Northern Europe. North America.

P. nobilis Ehrb.

Ehrb. Berl. Ak. 1840, p. 214. A. Schm. Atlas pl. 43, f. 1.

Rare: Stene r; the Ostnesfiord r.

Distribution: Fresh water species, especially frequent in Northern and Western Europe.

b. ***Divergentes*** Cl. l. c. p. 77.

P. legumen Ehrb.

Ehrb. Mikrogeol. pl. II, 2, f. 12. *Navicula l.* A. Schm. Atlas pl. 44, figs. 44—47.

Very rare: The Ostnesfiord, r.

Distribution: Fresh water species, frequent especially in Northern and Western Europe. Africa. Asia. Australia. America.

P. divergens W. Sm.

W. Sm. Brit. Diat. I, p. 57, pl. 18, f. 177. *Navicula d.* A. Schm. Atlas pl. 44, f. 9.

Very rare: The Østnesfiord, r.

Distribution: Fresh water species, frequent especially in Northern and Western Europe. Asia. Australia. America.

c. ***Distantes*** Cl. l. c. p. 80.

P. lata (Bréb.) W. Sm.

W. Sm. Brit. Diat. I, pl. 18, f. 167. *Frustulia lata* Bréb. Cons. p. 18.

Frequent: Svolvær r, Raftsund r, the Østnesfiord r, Stene + c.

Distribution: Fresh water species. Arctic regions. Western Europe. Switzerland. Australia.

P. borealis Ehrb.

Ehrb. Am. pl. I, 2, f. 6. *Navicula b.* A. Schm. Atlas pl. 45, figs. 15—21.

Very rare: Stamsund, r r.

Distribution: Frequent fresh water species, especially in arctic and alpine regions: Northern and Western Europe; Switzerland. Asia, Africa, America and Australia.

d. ***Marinæ*** Cl. l. c. p. 94.

P. quadratarea (A. Schm.) Cl.

A. Schm. Nords. Diat. p. 90, pl. II, f. 26. *Navicula pinnularia* Cl. Svensk. N. Diat. p. 224, pl. IV, figs. 1—2 (earlier name).

Frequent: Stamsund +, Svolvær r, the Østnesfiord r, Stene r +, Gaukværø + c.

Distribution: Coasts of the North Sea. Arctic regions, frequent. The Mediterranean. Australia.

P. claviculus (Greg.) Cl.

Cl. l. c. p. 96. *Navicula c.* Greg. Diat. of Clyde, p. 478, pl. IX, f. 5. A. Schm. Nords. Diat. pl. II, f. 28.

Rare: Stamsund r +, Gaukværø r.

Distribution: Coasts of the North Sea. Sweden. Balearic Islands.

P. cruciformis Donk.

Donk. Micr. Journ. (n. s.) I, p. 10, pl. I, f. 7. A. Schm. Nords. Diat. pl. II, f. 25

Rare: Stamsund r, Svolvær r, Gaukværø r.

Distribution: Coasts of the North Sea. Finmark. Baltic. West Indies. Cape Horn. Seychelles.

P. Trevelyana (Donk.) Rabenh.

Rabenh. Fl. Eur. Algar I, p. 210. *Navicula T.* Donk. Micr. Journ. I, 1861, p. 8, pl. I, f. 2.

Rare: Stamsund r, Svolvær r, Stene r.

Distribution: Coasts of the North Sea. Florida. Japan.

Diploneis Ehrb., Cl. Synops. Navic. Diat. I, p. 76.

The material examined was especially rich in forms of this beautiful genus. For the sake of greater clearness, they are arranged in the two groups Didymæ and Ellipticæ, although these groups by some intermediate forms pass into each other.

a. ***Ellipticæ*** V. H. Synops.

D. hyalina (Donk.) Cl.

Cl. l. c. p. 80. *Navicula h.* Donk. Micr. Journ. I, p. 10, pl. I, f. 6. A. Schm. Atlas pl. 70, figs. 1—5.

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea. Finmark.

D. coffeæformis (A. Schm.) Cl.

Cl. l. c. p. 81. *Navicula c.* A. Schm. Nords. Diat. p. 88, pl. I, f. 22; pl. II, f. 13.

Perhaps a variety of the following species.

Rare: Stamsund, r +.

Distribution: Coasts of the North Sea. Naples. Macassar Straits.

D. suborbicularis (Greg.) Cl.

Cl. l. c. p. 81. *Navicula Smithii var. s.* Greg. Diat. of Clyde p. 487, pl. IX, f. 17.

Somewhat rare: Stamsund +, Svolvær r.

Distribution: Coasts of the North Sea. Davis' Strait. The Mediterranean. Caspian Sea. Indian Ocean. America.

D. eudoxia (A. Schm.)

Navicula e. A. Schm. Atlas pl. VIII, f. 40, pl. 70, f. 71. *N. mediterranea* A. Schm. Nords. Diat., pl. II, f. 10, non Kütz. *D. contigua var. eudoxia* Cl. l. c. p. 83.

This beautiful species is so easily recognizable and seems to be so well distinguished from the following that I prefer to keep them separate instead of referring both to *D. contigua*, as Cl. (l. c. p. 82) does.

Rare: Stamsund r +, Raftsund r.

Distribution: West coast of Norway. The Mediterranean. Red Sea. Indian Ocean. Galapagos Islands.

D. sejuncta (A. Schm.).

Navicula s. A. Schm. Nords. Diat. p. 87, pl. I, f. 18. *N. eugenia* A. Schm. Atlas pl. 8, figs. 44—45. *Diploneis contigua* (A. Schm.) *var eugenia* Cl. l. c. p. 83.

This species is certainly a *Diploneis*, not a *Caloneis* as Cl. l. c. supposes. A. Schm. (Nords.) compares it with *D. nitescens* and mentions it *(N. eugenia)* another time (Atlas l. c.) as a connecting link between *D. nitescens* and *D. eudoxia*.

Horns of the central nodule not plainly separated. Now and then, the division line is, however, seen. Costæ apparently lineate; the very faint longitudinal lines form a single row of alveoli between the costæ. Sometimes the valves are a little constricted in the middle.

I can find no essential difference between this form and *N. eugenia*. The costæ in the latter are stated to be 8—9 on 10 μ, in the former 12. The structure of *D. sejuncta* is, however, somewhat variable, and answers perhaps best to 10 costæ on 10 μ

There is also a remarkable agreement in their occurrence, as both are mentioned from Campeachy Bay.

Very rare: Stamsund r +, here in rather large numbers.

Distribution (of *N. sejuncta* A. SCHM.): West coast of Norway (Hvidingsø). Campeachy Bay.

Distribution of *N. eugenia* A. SCHM.: Ceylon. Macassar Straits. Campeachy Bay.

D. notabilis (GREV.) CL.

CL. l. c. p. 93. *Navicula notabilis* GREV. Micr. Journ. XI, p. 18, f. 9.

var. expleta A. SCHM.

A. SCHM. Nords. Diat. pl. I, f. 20, pl. II, f. 11.

Rare: Stamsund r, Raftsund r, Stene r, Gaukværø r.

Distribution: Coasts of the North Sea. The Mediterranean. Black Sea. Red Sea. Indian Ocean. Pacific Ocean. West Indies. Brazil.

D. fusca (GREG.) CL.

CL. l. c. p. 93. *Navicula fusca* A. SCHM. Atlas pl. 7, figs. 2—3 (*var. norvegica* CL. l. c.).

This species is exceedingly variable and includes probably *D. hyperborea* and *D. æstiva*. Even the limit towards *D. Smithii* seems not to be reliable.

Frequent: Moskenstrømmen r, Stamsund +, Svolvær +, the Østnesfiord r, Raftsund r, Stene r, Gaukværø +.

var. Gregorii CL. l. c. p. 94.

Navicula Smithii var f. GREG. Diat. of Clyde IX, f. 15.

Large, beautiful form. Differs from the main species in the same way as *D. major* CL. from *D. Smithii*. Central nodule elongated; terminal nodules distant from the ends.

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea. Naples.

D. hyperborea (GRUN.) CL.

CL. l. c. p. 95. *Navicula hyperborea* GRUN. Wien Verh. 1860 p. 531, pl. III, f. 16.

Furrows swelling round the central nodule.

Rare: Stene r, the Østnesfiord r, Stamsund r.

Distribution: Bohuslän (Sweden).

var. excisa A. SCHM.

Navicula fusca v. excisa A. SCHM. Nords. Diat. pl. II, f. 9.

Beautiful and characteristic form. Large, conspicuous pearls as in *D. fusca var. Gregorii*.

Rare: Stamsund, r +.

Distribution: West coast of Norway.

D. Smithii (BRÉB.) CL.

CL. l. c. p. 96. *Navicula Smithii* BRÉB. in W. SM. Brit. Diat. II, p. 92. A. SCHM. Atlas pl. 7, figs. 16—17.

Exceedingly variable, probably also including *D. major* and *D. borealis*.

Very frequent: Moskenstrømmen r, Stamsund c, the Østnesfiord r, Raftsund r, Stene c, Gaukværø c.

Distribution: Coasts of the North Sea, Baltic. Arctic regions. The Mediterranean. Indian Ocean. Pacific Ocean. Central America.

D. major CL.

CL. l. c. p. 96. *Navicula Smithii* A. SCHM. Atlas, pl. VII, f. 19.

Beautiful form, but hardly anything other than a coarse variety of *D. Smithii*. It seems quite impossible to keep it distinct from large forms of the latter species, with coarser structure.

The central nodule is usually broadened, broader than the distance between the horns, while it, in *D. Smithii*, is of equal breadth. The terminal nodules are generally distant from the ends, while they in *D. Smithii* lie close to them. Both these characteristics are, however, unreliable. Thus forms occur, which, on account of the structure and the terminal nodules, should be referred to *D. major*, but on account of the form of the central nodule to *D. Smithii*, and vice versa.

Not unfrequent: Moskenstrommen +, Stamsund r +, Stene r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean.

D. borealis (GRUN.) CL.

CL. l. c. p. 96. *Navicula Smithii var. borealis* GRUN. Diat. Franz Jos. Land p. 56, pl. I, f. 40.

Furrows swelling round the central nodule.

Frequent: Stamsund cc, Stene r, the Ostnesfiord r, Gaukværø r.

My specimens differ somewhat from GRUNOW's figure, especially in the central nodule, which is not elongated. The double rows of pearls between the costæ are very delicate, but are now and then distinctly seen. Agree very well with the description in GRUNOW l. c.

Distribution: Sweden (Bohuslän). Arctic regions. Java.

D. litoralis (DONK.) CL.

CL. l. c. p. 94. *Navicula l.* DONK. Brit. Diat. p. 5, pl. I, f. 2. A. SCHM. Nords. Diat. pl. I, figs. 24—25 („*var. subtilis*").

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Indian and Pacific Oceans.

D. nitescens (GREG.) CL.

CL. l. c. p. 97. *Navicula Smithii var. nitescens* GREG. Diat. of Clyde p. 487, pl. IX, f. 16.

Somewhat rare: Stamsund +, Stene r, Gaukværø r.

Distribution: Coasts of the North Sea. The Mediterranean. Black Sea. Indian Ocean. Pacific Ocean. Central America.

b. **Didymæ** VH. Synops.

D. constricta (GRUN.) CL.

CL. l. c. p. 83. *Navicula c.* GRUN. in Wien Verh. 1860, p. 535, pl. III, f. 18. *N. Donkinii* A. SCHM. Nords. Diat. pl. I, f. 12, pl. II, f. 8.

Coarser structure than in the following species, horns of the central nodule more divergent, and obtuse angles in the lateral contour. At a certain focus, a few very indistinct oblique longitudinal costæ are sometimes to be seen.

Not unfrequent: Stamsund +c, the Ostnesfiord r, Stene r.

Distribution: Coasts of the North Sea. Finmark. Balearic Islands. Ceylon. Florida.

D. incurvata (Greg.) Cl.

Cl. l. c. p. 84. *Navicula i.* Greg. Micr. Journ. IV, p. 44, pl. V, f. 13. A. Schm. Nords. Diat. pl. I, figs. 10—11; pl. II, f. 6.

Frequent: Stamsund + c, Stene r +.

Distribution: Coasts of the North Sea. Finmark. America.

D. interrupta (Kütz.) Cl.

Cl. l. c. p. 84. *Navicula i.* Kütz. Bacill. p. 100, pl. 29. f. 93. A. Schm. Nords. Diat. pl. I, f. 8.

Somewhat rare: Stamsund r, the Østnesfiord r, Raftsund r, Stene r.

Distribution: Brackish water. Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. East coast of America.

D. lineata (Donk.) Cl.

Cl. l. c. p. 85. *Navicula l.* Donk. Micr. Journ. VI, p. 32, pl. III, f. 17. A. Schm. Nords. Diat. pl. I, figs. 16—17.

Rare: Stamsund r, Stene r. Both forms illustrated by A. Schm. l. c., occur.

Distribution: Coasts of the North Sea. The Mediterranean.

D. subcincta (A. Schm.) Cl.

Cl. l. c. p. 86. *Navicula s.* A. Schm. Nords. Diat. pl. II, f. 7.

Very variable. Structure coarse, coarser than in the preceding species.

Frequent: Svolvær r +, the Østnesfiord r +, Raftsund r, Stene + c.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Indian Ocean.

var. media (Grun.)

Navicula bomboides var. media Grun. Arct. Diat. p. 41, pl. III, f. 54; Diat. Franz Jos. Land pl. I, f. 39 *(N. subcincta). Diploneis entomon* Cl. Synops. Navic. Diat. I, p. 87.

Two, or a few, broad, irregular longitudinal costæ, anastomosing through oblique ones.

This form is very remarkable. By Cleve it has been referred to *D. entomon* (cf. under that species), by Grunow as a variety to *D. bomboides.* Grun. has, however, noted the close relationship to *D. subcincta.* As this species is very variable as regards the development of longitudinal costæ, and often shows similar peculiarities as the present variety, I have thought it best to consider the latter a variety of *D. subcincta*, though it is, on the whole, so characteristic that it might very well be regarded as a separate species.

I also think I have seen forms distinctly transitional to *N. subcincta.* Such forms are, however, rare.

Not unfrequent: Stamsund r +, the Østnesfiord r +, Raftsund r, Stene r.

Distribution: Arctic regions.

D. entomon.

Regarding the interpretation of this name Cl. l. c. is not quite clear. His species seems to be = A. Schm. Nords. Diat. pl. I, f. 14, a figure, on which the longitudinal costæ are very indistinct. Cl. quotes, however, also A. Schm. l. c. f. 13, a figure which undoubtedly represents another species. A. Schm. himself remarks that these two figures cannot be referred to the same species, but that Grunow considers them to be *D. entomon* Ehrb.

Cleve's species is partly identical with *D. bomboides var. media* Grun. (in Cl. et Grun. Arct. Diat. p. 41, pl. III, f. 54), a form, which, according to Grunow, is an intermediate one between *D. bomboides* and *subcincta.* This *var. media* I have referred to *D. subcincta* (cf. above). It is hardly essentially different from that form from Franz Jos.'s Land, which Grun. illustrates (Diat. F. J. L. pl. I, f. 39) as *Navicula subcincta.* In this figure the irregular ramification of the longitudinal costæ is seen, producing two anostomosing ones.

The figures from A. Schm. Atlas (pl. 13, figs. 48—49) referred to by Cl. l. c. represent a species, which I have not seen, and which hardly occurs with us.

D. entomon of Van Heurck Traité p. 195, pl. 26, f. 732 is a different species, identical with A. Schm. Nords. Diat. pl. I, f. 13. This figure seems, however, to represent a form of *D. constricta.* The furrows, especially, answer very well to the latter species. Van Heurck who is on the whole conservative on the question of species, also mentions the near relationship between *D. entomon* and *D. incurvata*, a species which again is very nearly connected with *D. constricta.*

When Cleve l. c. remarks that *D. entomon* by intermediate forms passes into *D. splendida*, this also shows clearly that his species is different from that of A. Schmidt (f. 13) and Van Heurck.

The furrows of *D. entomon* Cl. answer very well to those of *D. bomboides*, less so to those of *D. splendida.*

I have, however, never seen specimens where it was doubtful, whether they should be referred to *D. entomon* Cl. (= *bomboides var. media* Grun.) or *D. bomboides.*

D. entomon Ehrb. Mikrogeologie pl. 33, XVII, f. 13 has the shape of *D. constricta*, but very narrow furrows. *D. entomon* Ehrb. l. c. may be Van Heurck's species (A. Schm. Nords. Diat. pl. I, f. 13); the specimen seems to lie somewhat obliquely, which may have caused the median constriction of the furrows.

D. splendida (Greg.) Cl.

Cl. l. c. p. 87. *Navicula s.* Greg. Micr. Journ. IV, p. 44, pl. V, f. 14. A. Schm. Nords. Diat. pl. I, figs. 3—4; pl. II, f. 2.

This beautiful species is very similar to *D. bomboides*, but the furrows do not swell in the middle and narrow evenly elliptically off towards the ends. The costæ, besides, distinctly cross the furrows at the sides of the central nodule (i. e., in the furrows are here distinct transverse costæ), while these furrows else are almost smooth. The median structure of the valve generally is a little coarser, the areoles here somewhat larger.

I have seen no distinct transition between *D. splendida* and the other species.

Somewhat rare: The Østnesfiord r +, Raftsund r, Stene r +.

Distribution: Coasts of the North Sea. Arctic regions (Finmark, Baren Eiland, Spitsbergen, Greenland). Indian Ocean. Pacific Ocean. West Indies. Florida.

D. bomboides (A. Schm.) Cl.

Cl. l. c. p. 88. *Navicula b.* A. Schm. Nords. Diat. pl. I, f. 2.

Similar to the preceding species, but the furrows swell slightly round the central nodule, and the structure here is like that of the

other parts of the valve. The furrows are also more protracted towards the ends, and not conspicuously crossed by transverse costæ at the sides of the central nodule.

Always easy to distinguish from the preceding species.

Frequent: Stamsund + c, Brettesnes—Skroven r +, Raftsund r +, Stene r +.

Distribution: Coasts of the North Sea. Alexandria. Indian Ocean. Pacific Ocean. Central America.

D. didyma (Ehrb.) Ehrb.

Ehrb. Mikrogeolog. pl. 19, f. 32. *Pinnularia d.* Ehrb. Kreideth. p. 75. *Navicula didyma* A. Schm. Nords. Diat. pl. I, f. 7.

Not unfrequent: Moskenstrømmen r, Svolvær r +, the Østnesfiord r, Raftsund r, Stene r.

Distribution: Especially in brackish water. Coasts of the North Sea. Arctic regions. Baltic. Black Sea. Caspian Sea. Indian Ocean. Pacific Ocean. Cape Horn. West Indies.

D. bombus Ehrb.

Ehrb. Mikrogeol. pl. 19, f. 31. *Navicula b.* Greg. Diat. of Clyde, p. 484, pl. IX, f. 12. *N. gemma* A. Schm. Nords. Diat. pl. I, f. 1; pl. II, f. 1.

Frequent: Moskenstrømmen r +, Stamsund c, Svolvær +, the Østnesfiord r, Raftsund r, Stene +, Gaukværø r +.

Distribution: Coasts of the North Sea and Western Europe. Finmark. The Mediterranean. Black Sea. Caspian Sea. Indian Ocean. Pacific Ocean. America.

D. chersonensis (Grun.) Cl.

Cl. l. c. p. 91. *Navicula c.* Grun. in A. Schm. Atlas pl. 12, f. 40; pl. 69, f. 21. *Navicula apis* (Donk.) A. Schm. Nords. Diat. pl. I, f. 9.

Not unfrequent: Stamsund +, Svolvær r, Gaukværø r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean. West Indies. Florida.

D. crabro Ehrb.

Mikrogeol. pl. 19, figs. 29 a, b (non c). A. Schm. Nords. Diat. pl. I, figs. 5—6; pl. II, f. 4. *D. crabro var. multicostata* (Grun.) Cl. l. c. p. 102. *Navicula multicostata* Grun. Wien Verh. 1860, p. 524, pl. III, f. 13.

Rather frequent: Moskenstrømmen r, Stamsund +, the Østnesfiord +, Raftsund r, Stene r, Gaukværø r +.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. West Indies.

var. pandura (Bréb.) VH.

Van Heurck Synops. pl. 9, f. 1. *Navicula pandura* Bréb. Diat. Cherb. f. 4. A. Schm. Nords. Diat. pl. II, f. 3.

Peculiar form with tongue-shaped segments.

Very rare: Gaukværø, r r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. America.

Frustulia Ag.

F. rhomboides (Ehrb.) De Toni.

De Toni Syll. p. 277. *Navicula rhomboides* Ehrb. Amer. pl. 3, I, f. 15. *Vanheurckia r.* Bréb. Ann. Soc. phyt. Belg. I, p. 204. V. H. Synops. p. 112, pl. 17, figs. 1—2.

Very rare: Svolvær r, Brettesnes—Skroven r.

Distribution: Fresh water species, rather common.

Stenoneis ***inconspicua*** (Greg.) Cl.

Cl. Synops. Navic. Diat. I, p. 124. *Navicula? i.* Greg. Diat. of Clyde p. 478 pl. IX, f. 3. *N. fistula* A. Schm. Nords. Diat. pl. II, f. 29.

Frequent: Moskenstrømmen r, Stamsund r, Gaukværø + c.

Distribution: Coasts of the North Sea. Bohuslän (Sweden). Balearic Islands. Arctic regions.

Trachyneis ***aspera*** (Ehrb.) Cl.

Cl. Synops. Navic. Diat. I, p. 191. *Stauroptera a.* Ehrb. Amer. pl. I, figs. 1—2; Mikrogeol. pl. 35 A, XXIII, f. 13. *Navicula a.* Van Heurck Synops. pl. X, f. 13 (*var. genuina* Cl.).

Common: Moskenstrømmen r, Stamsund + c, Svolvær +, the Østnesfiord c, Raftsund r +, Stene c, Gaukværø +.

Distribution: Cosmopolitan.

Mastogloia Thw.

M. exigua Lewis.

Lewis Proc. Ac. Nat. Sc. Philad. 1861 p. 65, pl. II, f. 5. Van Heurck Synops. p. 70, pl. 4, figs. 25—26.

Very rare: Svolvær, r.

Distribution: Brackish and marine: Baltic. Belgium. Atlantic coast of America. Behring Island.

M. Smithii Thw.

W. Sm. Brit. Diat. II, p. 65, pl. 54, f. 341. Van Heurck Synops. p. 70, pl. 4, f. 13.

Very rare: Svolvær, r.

Distribution: In brackish water. Baltic. England. Saxony. Caspian Sea. Australia.

M. apiculata W. Sm.

W. Sm. Brit. Diat. II, p. 65, pl. 62, f. 387. A. Schm. Atlas pl. 185, f. 43; pl. 186, f. 23.

Very rare: Svolvær, r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Black Sea. China.

17. Cymbelleæ.

Cymbella Ag.

C. cistula (Hempr.) Kirchn.

Van Heurck Synops. p. 64, pl. 2, figs. 12—13.

Very rare: Brettesnes—Skroven, r.

Distribution: Fresh water species, frequent in arctic, northern or alpine localities. Also in slightly brackish water.

C. cymbiformis (Ag.?) V. H.

Van Heurck Synops. p. 63, pl. II, figs. 11 a—c.

Very rare: Stamsund r; the Østnesfiord r.

Distribution: Frequent fresh water species, especially from Northern and Western Europe. Arctic regions Asia, Africa, America and Australia.

Amphora Ehrb.

Amphora Cl. s. s., Synops. Navic. Diat. II, p. 100.

Valves with transverse rows of coarse puncta, forming longitudinal lines, or strong transverse costæ, crossed by longitudinal ones. Connecting zone simple.

A. proteus Greg.
Greg. Diat. of Clyde p. 518, pl. XIII, f. 81. A. Schm. Atlas, pl. 27, f. 3.

Very variable.
Frequent: Stamsund +, Svolvær r, Raftsund r, Stene +, Gaukværø + c.
Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Black Sea. The Atlantic, Indian and Pacific Oceans.

var. contigua Cl.
Cl. l. c. p. 103. A. Schm. Atlas, pl. 28, f. 4.

Perhaps a separate species.
Not unfrequent: Stamsund r, Svolvær r, the Østnesfiord r.
Distribution (of *var. contigua* Cl.): North Sea. The Adriatic. Labuan. New Caledonia.

A. robusta Greg.
Greg. Diat. of Clyde p. 519, pl. XIII, f. 79.

Not unfrequent: Stamsund r, the Ostnesfiord +.
Distribution: Coasts of the North Sea. Spitsbergen. The Mediterranean. Macassar Strait. Pacific Ocean.

A. ovalis Kütz.
Kütz. Synops., figs. 5—6. Van Heurck Synops. p. 59, pl. I, f. 1.

Very rare: Stamsund, r.
Distribution: Fresh or slightly brackish water. Frequent in Northern and Western Europe. Arctic regions.

b. ***Diplamphora*** Cl. l. c. p. 107.

Connecting zone complex, with more or less numerous longitudinal divisions and transverse striæ or costæ. Valves with transverse costæ, or rows of puncta, on the dorsal side with one or two longitudinal lines.

A. crassa Greg.
Greg. Micr. Journ. V, p. 72, pl. I, f. 35; Diatoms of Clyde p. 524, pl. XIV, f. 94. A. Schm. Atlas pl. 39, f. 30.

Rare: Stamsund r, Svolvær r, Stene r.
Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Indian Ocean. China.

var. solsvigiensis Petit.
Petit Diat. Cap Horn, p. 120, pl. X, f. 15, p. p. A. Schm. Atlas pl. 48, f. 17.

Beautiful form.
Very rare: Stamsund, r. 111 $\times$ 18 μ; costæ $4\frac{1}{2}$ on 10 μ, lineate. Strong longitudinal line. The costæ answer to the fig. 18 in A. Schm. Atlas, the margin of the ventral side to fig. 17 (these figures thus correspond to different focussing).

A. Græffii Grun.
Grun. in A. Schm. Atlas pl. 25, fig. 40.

Very rare: Stamsund, r. 63 $\times$ 14 μ; striæ 17 on 10 μ, crossed on the dorsal side by a blank line. Ends little protracted. Axial area a little constricted in the middle.
Not unfrequent: Stamsund r +, Stene +, Gaukværø r.
Distribution: Naples. Indian Ocean. Pacific Ocean.

A. Grevilleana Greg.
Greg. Micr. Journ. V, p. 73, pl. I, f. 36. Diat. of Clyde p. 522, pl. 13, f. 89. A. Schm. Atlas pl. 25, f. 41. *A. fasciata* Greg. l. c. pl. 13, f. 90 (cfr. Cl. l. c.).

Rare: Stamsund r, Stene r.
Distribution: Coasts of the North Sea and Western Europe. Spitsbergen. The Mediterranean. Pacific Ocean. Central America.

A. sulcata Bréb.
Bréb. Diat. Cherb. f. 8. Greg. Diat. of Clyde p. 523, pl. XIII, figs. 92, 92 b. Cl. l. c. p. 112.

Very rare: Stamsund r, the Østnesfiord r. 15 striæ on 10 μ. 74 μ long. Corresponds exactly to the figures and description in Gregory l. c. Also tolerably well answering to Cleve's species.
Distribution: West coast of Europe. Balearic Islands.

A. Mülleri A. Schm.
A. Schm. Atlas pl. 26, f. 31. *A. monilifera* Greg.? Diat. of Clyde, p. 511, pl. XII, f. 69.

Very rare: Stamsund, r. Valve 73 $\times$ 11 μ, with $7\frac{1}{2}$ striæ on 10 μ, obtuse. The ventral side as illustrated by A. Schm., rather narrow, towards the ends broader, then again narrowing. The raphe is not so distinctly bent as in the figure. On the broader part of the ventral side, inside the marginal striæ, there is a band of short striæ, as in *A. proteus*, separated from the marginal striæ by a blank line. Dorsal striæ, as in the figure mentioned, crossed by a broad blank, longitudinal line. Another sharp line is seen close to the dorsal margin.
Distribution: West coast of Norway (Hvidingsø).

A. alata Perag.
Perag. Diat. de Villefr. p. 41, pl. II, f. 11. Van Heurck Traité d. Diat. pl. 24, f. 677.

Very rare: Stamsund, r.
Distribution: West coast of Norway. Morocco. The Mediterranean. Macassar Straits. America.

A. binodis Greg.
Greg. Diat. of Clyde p. 510, pl. XII, f. 67. Cl. l. c. p. 124.

Very rare: Stamsund, r. 34 μ long. Completely answering to the illustration in Greg. l. c.
Distribution: Scotland. Balearic Islands.

c. ***Halamphora*** Cl. l. c. p. 117.

Connecting zone complex. Raphe close to the ventral margin. Transverse, punctate striæ, not crossed by any longitudinal line. Ends of the valve usually rostrate or capitate.

A. macilenta GREG.

GREG. Diat. of Clyde p. 510, pl. XII, f. 65. CL. l. c. p. 121.

Answers best to *A. ergadensis* GREG. l. c. p. 512, pl. XII, f. 71, which by CLEVE l. c. — probably rightly — is considered a variety of *A. macilenta*. Frustule 48 × 19 μ, with rather narrow connecting zone. 11 striæ on 10 μ.

Very rare: Stamsund, r.

Distribution: Coasts of Sweden and Scotland. The Mediterranean. Macassar Straits.

A. eunotia CL.

CL. Diat. Arct. Sea. p. 21, pl. III, f. 17. *A. cymbifera var.* A. SCHM. Atlas pl. 25, f. 35.

Very rare: Stamsund, r.

Similar to an *Amphora terroris*, with distinctly punctate transverse striæ. Valve 80 × 15 μ; its ends a little capitate-rostrate. Striæ $7^1/_2$ on 10 μ.

Distribution: Bohuslän (Sweden). Arctic regions. Indian Ocean.

A. costata W. SM.

W. SM. Brit. Diat. I, p. 20, pl. 30, f. 253. GREG. Diat. of Clyde p. 527, pl. XIV, f. 99. *A. inflata* GRUN. in A. SCHM. Atlas pl. 25, figs. 29—30.

Rare: Stamsund, r.

Frustule 34 × 16 μ, coarse structure; 9—10 striæ on 10 μ; many longitudinal division lines. Ends protracted.

Distribution: Coasts of the North Sea. Mediterranean. Sumatra. East coast of America. Galapagos Islands.

A. terroris EHRB.

A. crebi EHRB. Microgeol. pl. 35 A, f. 2. *A. cymbifera* GREG. Diat. of Clyde p. 526, pl. XIV, f. 97. A. SCHM. Atlas pl. 26, f. 33; pl. 39, f. 18; pl. 25, figs. 17—19, 33—34, 36.

Not unfrequent: Stamsund +, the Østnesfiord r, Gaukværø r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Macassar Straits. Gulf of Mexico.

d. **Oxyamphora** CL. l. c. p. 125.

Complex connecting zone. Valves acute with the raphe close to the ventral margin. No dorsal longitudinal lines. Usually delicate structure of transverse or slightly radiate striæ with puncta arranged in undulating, longitudinal lines. Ventral side usually of still finer structure than the dorsal side. Often a stauros.

A. acuta GREG.

GREG. Diat. of Clyde p. 524, pl. 14, f. 93. A. SCHM. Atlas pl. 26, figs. 19—20.

Not unfrequent: Stamsund r, the Østnesfiord r, Raftsund r, Gaukværø r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. China. Straits of Magellan.

A. groenlandica CL.

CL. l. c. p. 128, pl. IV, f. 1.

No stauros.

var.

Median striæ 12 on 10 μ, towards the ends of the valve somewhat closer. Puncta elongated, 10 on 10 μ.

Very rare: Stamsund, r.

Distribution of the main species: Davis' Strait.

A. ostrearia BRÉB.

BRÉB. in KÜTZ. Spec. p. 94. A. SCHMIDT Atlas pl. 26, f. 23. VAN HEURCK Synops. p. 55, pl. 1, f. 25 (*var. typica* CL. l. c. p. 129).

Rare: Stamsund, r; Gaukværø, r.

Distribution: Coasts of the North Sea. Finmark. The Mediterranean. Indian Ocean. Pacific Ocean.

A. lævis GREG.

GREG. Diat. of Clyde p. 514, pl. XII, figs. 74 a—c. A. SCHM. Atlas, pl. 26, f. 10.

Rare: Stamsund, r +.

Distribution: Coasts of the North Sea. Finmark. Balearic Islands. Java.

var. lævissima (GREG.) CL.

CL. l. c. p. 130. *Amphora lævissima* GREG. Diat. of Clyde, p. 513, pl. XII, f. 72. A. SCHM. Atlas pl. 26, figs. 3, 13—14.

Rare: Stamsund r, Stene r.

Distribution: Coasts of the North Sea. Finmark. Sea of Kara.

e. **Amblyamphora** CL. l. c. p. 130.

Connecting zone complex. Valves obtuse with the raphe diverging dorsally. No longitudinal lines. Fine puncta, arranged in transverse striæ. Structure not finer on the ventral part of the valve.

A. obtusa GREG.

GREG. Micr. Journ. V. p. 72, pl. I, f. 34. A. SCHM. Atlas pl. 40, figs. 1—7, 11—13.

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea. The Mediterranean. Black Sea. Red Sea. Indian Ocean. China. East coast of America.

A. spectabilis GREG.

GREG. Diat. of Clyde, p. 516, pl. XIII, figs. 80 a, c. A. SCHM. Atlas pl. 40, figs. 18—23.

Not unfrequent: Stamsund +, Stene r, Gaukværø r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean. West Indies. Davis' Straits.

f. **Psammamphora** CL. l. c. p. 132.

Connecting zone simple. Else as *Amblyamphora*.

A. ocellata DONK.

DONK. Micr. Journ. 1861 (n. s.) I, p. 11, pl. I, f. 11. VAN HEURCK Synops. p. 56, pl. I, f. 26 (*var. typica* CL. c. p. 133).

Somewhat rare: Stamsund r, Svolvær r, the Østnesfiord r +, Gaukværø +.

Distribution: Coasts of the North Sea. Sweden. The Adriatic.

g. **Cymbamphora** CL. l. c. p. 134.

Connecting zone simple. Valves of rather delicate structure. No longitudinal lines. Raphe close to the ventral margin.

A. angusta GREG.? CL.

CL. l. c. p. 135. GREG.? Diat. of Clyde p. 510, pl. XII, f. 66 (*var. typica* CL.).

Rare: Stamsund, r. Hardly Gregory's species.

Distribution: Scotland. Arctic regions. East coast of North America. West Indies.

var. ventricosa (GREG.) CL.

CL. l. c. p. 135. *Amphora v.* GREG. Diat. of Clyde p. 511, pl. XII, f. 68.

Not unfrequent, Moskenstrømmen r, Stamsund r, the Østnesfiord r +, Stene r, Gaukværø +.

Answers completely to Gregory's species, but is very variable.

Distribution: Coasts of the North Sea. Sweden. Arctic regions. The Mediterranean. Red Sea.

Epithemia BRÉB.

E. turgida (EHRB.) KÜTZ.

KÜTZ. Bacill., pl. 5, f. 14. VAN HEURCK Synops., pl. 31, figs. 1—2. *Navicula t.* EHRB. 1830.

Fresh water species.

var. Westermanni (EHRB.) GRUN.

GRUN. in Wien Verh. 1862, p. 325. VAN HEURCK Synops. p. 138, pl. 31, f. 8. *Navicula W.* EHRB. 1833.

Very rare: Gaukværø, r; Moskenstrømmen, r.

Distribution: In brackish water. Coasts of the North Sea.

E. argus (EHRB.) KÜTZ.

KÜTZ. Bacill. pl. 29, f. 55. VAN HEURCK Synops. pl. 31, figs. 15—17. *Eunotia argus* EHRB., Mikrogeol. pl. XV A, f. 59.

Very rare: Brettesnes—Skroven r, Gaukværø r.

Distribution: Fresh water species; also in brackish water. Frequent, especially in Northern Europe and in alpine localities.

E. zebra (EHRB.) KÜTZ.

KÜTZ. Bacill. pl. 5, f. 12; pl. 30, f. 5. VAN HEURCK Synops. pl. 31, figs. 9, 11—14. *Eunotia z.* EHRB. Inf. p. 191, pl. 21, f. 19.

Very rare: Gaukværø r, Stene r.

Distribution: Common fresh water species.

E. musculus KÜTZ.

KÜTZ. Bacill. pl. 30, f. 6. VAN HEURCK Synops. pl. 32, figs. 14—15.

var. constricta (BRÉB.) V. H.

VAN HEURCK Synops. p. 140; Traité d. Diat. p. 297, pl. 9, f. 360. *Epithemia c.* BRÉB. in W. SM. Brit. Diat. I, p. 14, pl. 30, f. 248.

Very rare: Svolvær r, Gaukværø r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean.

E. gibberula KÜTZ.

KÜTZ. Bacill., pl. 30, f. 3. VAN HEURCK Traité d. Diat., p. 297, pl. 30, f. 825.

Rare: Svolvær, r.

var. producta GRUN.

VAN HEURCK Synops. pl. 32, figs. 11—13.

Rare: Stamsund, r.

Distribution: Marine, also in brackish and fresh water (*var. producta* GRUN.), frequent in Europe and America.

Rhopalodia *gibba* (EHRB.) OTTO MÜLL. 1895.

Epithemia gibba KÜTZ. Bacill. p. 35, pl. 4, f. 22. VAN HEURCK Synops. p. 139, pl. 32, figs. 1—2.

var. ventricosa (KÜTZ.) GRUN.

GRUN. in Wien Verh. 1862, p. 327. *Epithemia ventricosa* KÜTZ. Bacill. pl. 30, f. 9.

Very rare: Gaukværø, r; the Østnesfiord, r.

Distribution: Common fresh water species.

General remarks on the character of the bottom diatom flora.

The most striking facts regarding the distribution of the diatoms in the foregoing list of bottom species are, that the arctic forms are rare and that the flora, on the whole, has a much more pronounced southern character than would be expected from the geographical situation. This is in sharp contradistinction to the character of the diatom flora during „the diatom inflow" of plankton species in spring (cf. above p. 88), when the actual arctic species predominate.

Generally speaking, the bottom flora shows a remarkable agreement with that of the east coast of Scotland. It is especially striking that a great many of the species described by GREGORY in Diatoms of the Clyde (1854) are common to these two regions, situated at a rather considerable distance from each other. On the other hand, these species also occur on the west coast of Norway, at any rate most of them. It may, consequently, be concluded that the characteristic western bottom flora of diatoms which inhabit the coasts of the North Sea extend to the north as far as to past the Vest-Fiord, probably, however, but little farther.

For the sake of clearness, I divide the species found into 6 groups:

I. The actual arctic species, only found in the arctic region.
II. Species with a western and arctic distribution.
III. Species with a very wide distribution, occurring from southern regions right up into the arctic one. Some of these species seem to be cosmopolitan. In Europe, the species belonging to this group are generally found from the Mediterranean to the arctic regions.
IV. Western species, especially known from the coasts of the North Sea, but not before mentioned from the arctic zone.
V. Species with a southern and western distribution, generally occurring from the Mediterranean — or still farther to the south — to the coasts of the North Sea.
VI. Species with only southern distribution, not before found so far north as on the coasts of the North Sea.

Most of the species observed belong to group III, and many of these species will probably later on be found to have a still wider distribution than is at present known. For such more or less decidedly cosmopolitan species, a thorough treatise on their varieties and forms is a very important and valuable work, indispensable when one wishes to obtain an accurate knowledge of the distribution of identical and closely related species. Notwithstanding the extensive material consisting of an immense number of facts and observations, often made with the utmost care and accuracy as to details in structure, we are still obliged to acknowledge with regret that our knowledge of the individual variations and real constancy of the various distinguishing characters is very deficient.

These species play an unimportant part with regard to the character of the flora. It is, however, an interesting fact that, apparently, so many species of diatoms are common to most seas of the world. Even if a good many of these widely distributed species, on a more thorough examination, should prove to consist of similar, but separate species, having different areas of distribution, there will still remain a great number of species which, in Europe, occur from the Mediterranean to the Arctic Sea. It must, however, be remembered that the valves of diatoms are almost of eternal

duration and that thus fossil valves will enlarge the apparent area of distribution of the still living species.

Most of the species of this group III are probably recent ones, a great number of them being observed alive on the west coast near Bergen.

Next to group III it is group V, which contains the greatest number of species. Many of them have a predominating southern distribution, but occur, more or less frequently, as far north as the coasts of the North Sea. To this group belong the following (a few of which might perhaps rightly be reckoned to another group):

Coscinodiscus Rothii.
Biddulphia pulchella (a broken valve, Tromsø, Cl.).
B. regina (only exceptionally found as far north as Scotland).
B. favus (once found in Spitsbergen).
B. alternans.
B. punctata.
Synedra undulata.
S. Hennedyana.
Raphoneis nitida.
Dimeregramma minus.
D. fulvum.
Glyphodesmis distans.
Grammatophora serpentina.
Nitzschia punctata.
N. acuminata.
N. bilobata.
N. lanceolata (*α*).
Campylodiscus eximius.
Surirella fastuosa.
Achnanthes longipes.
Pleuroneis distans.
P. britannica.
Donkinia recta.
Pleurosigma rigidum.
P. formosum.
P. speciosum.
P. balticum.
Scoliotropis latestriata.
Caloneis consimilis.
C. blanda.
C. musca.
Stauroneis salina.
Navicula moniliformis.
N. latissima.
N. compressicauda.
N. superimposita.
N. palpebralis α, var. *Barclayana*, var. *angulosa.*
N. prætexta.
N. clarata.
N. forcipata var.
Pinnularia claviculus.
P. Trevelyana.
Diploneis coffeiformis.
D. lineata.
D. (contigua var.) *eudoxia.*
D. notabilis (var. *expleta).*
D. fusca var. *Gregorii.*
D. major.
D. nitescens.
D. sejuncta.
D. didyma.
D. chersonensis.
D. crabro et var. *pandura.*
Mastogloia apiculata.
Amphora proteus var. *contigua.*
A. macilenta.
A. costata.
A. binodis.
A. sulcata.
A. alata.
A. obtusa.
A. spectabilis.
A. ocellata.
Epithemia musculus.

Many of these species were for the first time described and illustrated in the work by Gregory above mentioned.

All these species have not previously been mentioned from the arctic zone. To this group should properly also most of those be reckoned which are previously known from the arctic zone, but only from the coast of Nordland („Finmarken").

Less numerous are the species of a mere western European distribution, group IV. Such species are, however, on the whole not numerous. Here belong the following species:

Coscinodiscus apollinis var. (west coast of Norway).
C. Normanni, C. fasciculatus A. Schm.
Actinocyclus crassus.
Actinoptychus splendens.
Biddulphia turgida.
Synedra baculus.
Nitzschia litorea.
N. navicularis (Spitsbergen?).
Campylodiscus parvulus.
Cocconeis lyra (west coast of Norway).
Pleurosigma attenuatum (?).
Caloneis liber.
Schizonema crucigerum (?).
Navicula northumbrica.
N. peregrina var. *kefwingensis.*
N. præsecta (west coast of Norway).
Diploneis hyperborea var. *excisa* (west coast of Norway).

These species, the first and the last ones only excepted, are common to Great Britain and Norway.

A closely related group is group II, including species with a predominating western area, though also occurring right up to the arctic zone. These are the following:

Coscinodiscus Kützingii.
Hyalodiscus scoticus.
Biddulphia rhombus.
B. Smithii.
Nitzschia apiculata.
Campylodiscus angularis.
Rhoicosigma arcticum.
Caloneis brevis.
Navicula directa et var. *subtilis.*
N. fortis.
N. distans.
N. palpebralis var. *semiplena.*
N. pygmæa.
Diploneis hyalina.
Amphora lævis.

The genuine arctic species, belonging to group I, are few:

Coscinodiscus borealis.
Actinocyclus alienus?
Biddulphia arctica.
Synedra kamtschaticum.
S. rostellata.
Grammatophora arctica.
Nitzschia Mitchelliana.
Gomphonema kamtschaticum.
Amphora groenlandica.
Diploneis entomon Cl. p. p. (= *D. subcincta* var. *media*).

All these species, except the last one, are besides very rare.

At last we have the remarkable group VI of only southern forms, partly only known from regions situated far to the south or even only from the tropical zone. Their distribution (as earlier known) extends northwards only as far as to the Mediterranean. To this group belong:

(*Coscinodiscus leptopus verus*).
C. nodulifer.
Aulacodiscus Kittoni.
A. Johnsonianus.
Biddulphia regina var.
B. lata.
Nitzschia (insignis var.) *spathulifera*
N. coarctata.
N. (Smithii var.) *notabilis.*
Amphora Græffii.

There may, however, be some doubt as to whether the forms observed of *Biddulphia lata* and *Amphora Græffii* are identical with those, which usually occur in southern regions. Moreover, *Coscinodiscus leptopus, Nitzschia spathulifera, N. coarctata, N. notabilis* and *Biddulphia regina* var. are all very rare and scarce. There remain, however, *Coscinodiscus nodulifer* and the two species of *Aulacodiscus*, all of which occur in comparatively large numbers, and in several samples. These species are easily recognizable, and have a pronounced tropical area of distribution.

Probably these species are all fossil, but I cannot at present with certainty decide this. *Coscinodiscus nodulifer* has most probably occurred as a plankton species.

All the species of groups IV, V and VI, a considerable number of species in all, have not before been known from the arctic zone.

Index.

IV. COMBINATION

OF

HYDROGRAPHICAL AND BIOLOGICAL FACTS.

NOTES.

In this section I have given some facts, which it has occurred to me might be of practical interest. It is, however, quite impossible to define clearly between practical and purely scientific marine investigations.

A. The natural Conditions of the Fiords.

One of our historians relates, that in a fragment of an ancient Irish annal it is told, that in the year 872 „one of the two Norwegian kings in Dublin, IVAR, went with a large army from Ireland to Lochlann (Norway) to aid his father who was at war with the king of Lochlann.“[1])

It must be said that the ancient Irish had found a particularly suitable name for the land, which is also in modern tourist language made famous as „the land of fiords“. The Norwegian series of fiords presents many interesting problems to the naturalist too, and a thorough examination of them will undoubtedly serve to throw light on many questions.

If one sets to work to make a thorough scientific investigation of a fiord, the facts obtained may be divided into three principal groups; those concerning the shape and situation of the fiord (topography), or concerning the medium with which the fiord basin is filled (hydrography) or concerning the plants and animals contained in it (biology). The object in view, in case of such an examination, should be to gain the greatest possible insight into the biological phenomena, but in order to attain this end, one will be compelled to study most carefully the topographical and hydrographical conditions of the fiord. As a part of the *topography* of the fiords one must, I think, consider such things as their geographical position, proportionate size, subdivisions, relative depths, the occurrence of barriers, rocks under water, holms and islands. In addition to these things, the nature of the bottom and the surrounding hills, the geological history of the fiord (e. g. the rise and fall in the shore line) etc., must be taken into consideration as belonging to the topography of a fiord. To the *hydrography* of the fiords may be reckoned all the facts and qualities concerning the medium which fills their basins, such as salinity, temperature, gaseity, transparency, the motions of the water (currents, waves, tides), formation of ice, inflow of rivers or streams etc. Finally, atmospherical conditions must also be taken into consideration as playing an important part in the physical state of a fiord (e. g. temperature, downfall, prevailing winds, atmospheric pressure etc.).

The *biology* of the fiords will include vegetable and animal life in their waters, at the bottom and in the bottom mud. The plan here suggested for the examination of a fiord must, I think, be taken to be tolerably complete, and I will look upon it as a guide in my future work. I must, however, at once confess that the investigations I have hitherto made in northern Norway do not make it possible to fill in very much of the frame work I have set up in the foregoing lines. I will, nevertheless, build up the skeleton in the hope that it may be solidly covered later on.

a. Topographical Notes.

The Geographical survey of the Norwegian coast has given us maps, in which very much of what I call the topography of the fiords is made clear. But the complete mapping out of the northern fiords is not yet finished. A good deal of information about the fiords will also be found in Prof. A. HELLAND's[2]) topographical works, and a description of the ground through which the fiords have dug their way, will be found in „Det nordlige Norges geologi“ (The Geology of Northern Norway) by Dr. H. REUSCH. The problem of the fluctuations in the shoreline are treated in detail by Dr. ANDREAS HANSEN.[3]) In a hydrographical paper concerning the western fiords,[4]) I have touched upon the effect which changes in the level of the sea have upon these inner parts of the fiords which are connected with the principal fiord by comparatively shallow currents.

As regards these currents, it seems pretty generally to be the case that they have forced their way through moraines, which in many instances cause the comparative continement. HELLAND[1]) mentions examples of this, in Kvænangen, both the „Stor“- and „Lille strømmen“ having forced themselves through old moraines. It is most probable, that the majority of the so-called „strømme“ (currents) in the fiords, run over such moraines.

With respect to the situation of a fiord, it is not only its geographical latitude which is of importance for its vegetable and animal life, a very weighty factor is also its relative position to the prevailing current in the surrounding ocean. Let us make an experiment. We cut a section along the 22nd degree of longitude (E of Greenwich) towards the boundary line of Finland and continue to cut along the boundary to Jacob's river on the south side of the Varanger Fiord. Then we turn this section around the point where the longitudinal line and the shore line of the continent intersect, so that the fiords of Finmark will lie in a direction which is approximately E—W. These fiords will then undoubtedly undergo a change in their biology, and notwithstanding that they were

[1]) Loch = lake, fiord.

[2]) Lofoten og Vesteraalen, Tromsø amt.

[3]) Norges geol. undersøgelses aarbog f. 1896—99.

[4]) Studier over naturforholdene i vestlandske fjorde. I. Hydrografi. Berg. Mus. aarb. 1903, no. 8.

[1]) Tromsø amt, II, p. 349.

now further north, the change would quite certainly be such that several boreal species would occur there, while some of the arctic ones would die out, or possibly retire into the innermost parts of the fiords. Such a change would take place, because the fiords in this way would have been brought into closer contact with the heat axis of the northwards flowing current.

On the relative depths of the fiords, I have made some remarks in the first part of this work, and reference should also be made to the coast maps. The Finmark fiords are of rather a different character than those in Nordland and Tromsø amts, for they are comparatively shallow. An explanation of this has been given by Dr. ANDREAS HANSEN[1]) who writes: — „When the highland ceases in Finmarken, the fiords too acquire another character. They become broader and shallower, less typically formed basins in the loose schist, beds, indeed, for less active and less concentrated glacier-streams, because here, in the low plateau country, there were not originally such deep cañons to determine the course of the glaciers, as on the western slope of the mountains.“ As a general rule it may be said that there is a deep channel in the fiords with a muddy bottom. On either side, there is a bank or edge of land, which in some cases is evenly sloped, but generally has a most uneven surface. It is, nevertheless, in many instances, possible in a definite section to speak of the angle of inclination of the bank of land.

It is clear that, the depth being the same, the side surfaces will increase in proportion to the diminution of the angle of inclination, as will be seen from the figure below, which represents a transverse section through a fiord.

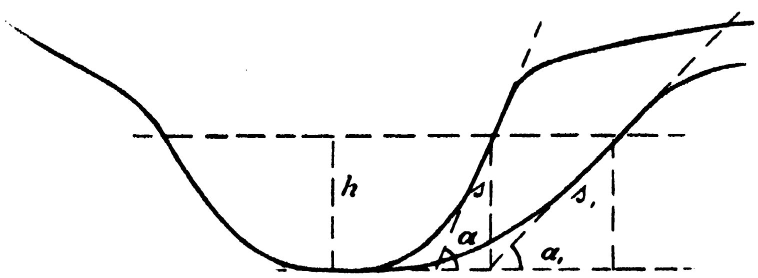


Fig. X.

If in the one case, the line of intersection between the side-area and the transverse section be s and the angle of inclination α, and in another case the corresponding values be s_1 and α_1 we get: —

$$s = \frac{h}{\sin \alpha}$$

$$s_1 = \frac{h}{\sin \alpha_1}$$

$$s : s_1 = \sin \alpha_1 : \sin \alpha.$$

Are the side surfaces (S and S_1) taken to have equally long ground lines, or if one will, shore lines, but with different angles of inclination (α and α_1) one gets, according to elementary geometrical law: —

$$S : S_1 = s : s_1 \text{ but hence follows: —}$$

$$S : S_1 = \sin \alpha_1 : \sin \alpha.$$

[1]) Norway, Official Publication for the Paris Exhibition 1900, p. 17.

The side surfaces are thus in inverse proportion to the sinus of the angles of inclination.

$$\text{Eg.} \quad \alpha = 90^0, \ \alpha_1 = 30^0, \text{ and then: —}$$

$$S : S_1 = \frac{1}{2} : 1$$

$$S_1 = 2 \ S.$$

When the angle of inclination is 30°, the side surface will thus be double as large as it is when the land bank is perpendicular.

This little mathematical exposition is valuable in so far as it plainly shows that the space which is available for the distribution of animals depends, to a great extent, upon the angle of inclination of the edge of land. And it gains in interest when it is remembered that experience proves that the edges, both in the ocean and the fiords, teem with animal life.

The presence of islands, holms, rocks etc. in a fiord must also be said to be important factors in the animal life of a fiord. They all tend to increase the extent of the particularly productive areas.

Another important factor in the vegetable and animal life of a given district, is the occurrence of a belt of skerries („skjærgaard“). With respect to navigation, such belts of skerries act as powerful breakwaters. And as such they are biologically too of importance, and of course the many islands, holms and rocks, with their rich algae vegetation, greatly increase the number of specially productive surfaces.

Mr. M. FOSLIE of Trondhjem has kindly given me some information about the influence of such a „skjærgaard“ on algae. He writes that where there is none it will, amongst other effects, also be found that the number of species is less. If the coast be an open one, a number of species which require more or less protected spots is as a rule absent. With Mr. FOSLIE's permission, I quote a part of his letter to me, he writes: — „Those species which are principally found on the open coast, will also generally be found inside the „skjærgaard“ or in the larger fiords, but usually in the most exposed places, and even there they are not so strong and well developed as on the ocean coast. An illustration may be found in the large Laminarians. *L. hyperborea* and *L. digitata* are always large and strong in the open sea, but decrease in size and change their shape the further in one finds them. A total absence of some „breakwater“ or other often results in the tearing away of large quantities of algae, which the autumn and winter storms drive ashore. I have, for instance, seen immense masses of Laminaria cast in, especially in Berlevaag and Loppen. On the other hand, there are species which are less hardy, and they are smaller on the open coast than in more sheltered places, even if they are found on the coast. They then go further down, where the rush of the waves is less. Therefore, especially along the coast of East Finmark, there are many places where vegetation seems to be poor and only to consist of a few species, while there is comparatively rich vegetation in fairly sheltered bays.“

An exceedingly important factor in the hydrography and biology of the fiords, is their relative position to the prevailing summer and winter winds, and a closer study of these things will probably throw light upon many matters which hitherto have been uncertain.

b. Hydrographical Notes.

In the first part of this work, a number of hydrographical data from the fiords will be found. Now I will mention a few more details, and treat of some things which have not yet been mentioned. First then, some remarks on the influence which the prevailing winds, waves and tidal currents exert on vegetable and animal life in the sea.

In a very interesting paper, Mr. F. W. Harmer has recently explained the importance of the prevailing winds as a geological factor.[1]) Mr. Harmer calls attention to the fact that dead shells are not found in large numbers on the eastern shores of the counties of Norfolk and Suffolk, although there is no want of molluscs in the adjacent sea. The reason for this absence of shells is found by Mr. Harmer in the fact that the prevailing winds at present are westerly. On the contrary, the presence of Crag beds on the east coast presupposes a different prevailing wind from that which is now the case.

„Easterly gales might have been prevalent in that part of the North Sea, rather than those from a westerly quarter, as at present.“ In another paper, Mr. Harmer[2]) has drawn attention to the tidal currents as a geological factor.

He points to the state of things in the Irish Sea, „where an accumulation of dead shells on the Turbot bank, off the coast of Antrim, is caused by the tidal currents which sweep with much velocity through the narrow channel separating Ireland from Scotland.“ The fact that in some places in Coralline Crag, layers of large shells may occur, while at other places smaller shells are predominant, is considered in the light of tidal currents, for Mr. Harmer says: — „Shells are sorted out by currents of varying strength as pebbles in beds of gravel; small specimens would therefore have accumulated in one place, larger ones in another, and comminuted shells, or fine calcareous sand in a third.“

Wind and current are not of little importance in dynamical geology, on account of their carrying power. But just this characteristic causes these factors also to have an influence, in different ways, upon living creatures. The course of a current offers particularly favourable conditions for the nourishment of plankton-eaters, and a current-facies of animals may be spoken of. It is true that animal life is not profuse where the deposits of material are greatest, but, on the whole, it is correct to say that the bed of a current is profusely supplied with animal life.

In a purely theoretical light, the supply of plankton for a given animal must be in proportion to the velocity of the current. It is, at any rate, evident that the motions of the water are of great importance in connection with the supply of nourishment for plankton-eaters.

Dr. Edward Browne[3]) has drawn attention to the fact that medusae, which are kept in an aquarium where the water is undisturbed, will at first swim quickly about, „but in a few hours, it sinks to the bottom, apparently tired out. After an interval of rest, it takes another swim, and again sinks to the bottom. This is repeated until the medusa becomes exhausted; then it stays at the bottom and slowly dies.“ This unfortunate state of things has been remedied by Dr. E. T. Browne and Dr. E. I. Allen having succeeded in constructing an apparatus by means of which the movements of the water have been skilfully imitated. Mr. Dannevig's hatching apparatus is constructed on a similar principle. With regard to the force of the tidal currents, it will easily be seen that this will depend upon the height of the tide, i. e. the difference between ebb and flow. In the north of Norway, this difference is, on an average, about 2 mtrs., and as a consequence of this, the tidal currents are considerably strong in the narrow channels and in the smallest parts of the fiords. Based upon material furnished by the Norwegian „Gradmaalingskommission“,[1]) I will give some figures which show the average difference between high and low tide in succession in 1884 and 1885.

	1884.	1885.
Stavanger	0.424 m.	0.427 m.
Bergen	0.988 „	0.975 „
Kabelvaag	2.010 „	2.014 „
Vardø	2.195 „	2.175 „

Generally speaking, it may be said that the tidal wave runs northwards along the coast, and the tidal currents flow into the fiords when the tide rises and outwards when it falls.

In the channels of the „skjærgaard“, it may be taken as a general rule, that the direction of the current is northerly or easterly when the tide rises, westerly or southerly when it falls. But it must be remarked that in many channels the direction of the current changes a little after the water has been at its highest and lowest. In the currents running between the islands of Lofoten (Gimsøstrøm, Napstrøm, Sundstrøm etc.) the water at first flows northwards when the sea is at half-high-tide and turns again at half-low-tide. The same is said to be the case in the currents which connect the Skjerstad and Salten Fiords. The best known of these is the socalled „Saltstrøm“, which surpasses even „Moskenstrømmen“ in force.

I have attempted, in an article on the two mael streams in Norway, (de to store malstrømme i Norge)[2]) to explain the change in the direction of currents at half-high and half-low-tide, and have theoretically worked out the following conclusion: — If the inner part of a fiord be connected by a current with the principal fiord, and the direction of this current be changed after high and low tide, the difference between ebb and flow will be less inside than outside the said current.

Thus, the difference between the niveau at high and low water should be less in the Skjerstad than in Salten Fiord. I have not as yet had an opportunity of verifying this theoretical conclusion.

Concerning the direction of the surface stream along the coast of Norway, Mohn's current map is very instructive.[3]) The following amusing little story shows that there, in the summer, may be an easterly current along the coasts of Finmarken. Sophus Tromholt[4]) relates that in the beginning of the eighties S/S. „Nordstjernen“ was in the summer wrecked on Knivskjælodden, a little west of the North Cape, and very soon sank. A couple of months later, the vicar of Næsseby had rowed out a little way in

[1]) Influence of Winds upon Climate during the Pleistocene Epoch. Quart. Journ. Geol. Soc., vol. LVII, 1901, p. 408.

[2]) A Sketch of the later tertiary History of East Anglia. Proc. Geol. Assoc., vol. XVII, 1902, p. 425.

[3]) On Keeping Medusae alive in an Aquarium. Journ. Mar. Biol. Assoc., N. S. Vol. V, no. 2, 1898.

[1]) Cf. Vandstandsmaalinger, h. IV, p. 124.

[2]) „Naturen“ 1901, p. 305.

[3]) The North Ocean, pl. XLIII.

[4]) Under Nordlysets Straaler, p. 557. Copenhagen 1885.

the Varanger Fiord and suddenly he caught sight of a little box floating in the water. On closer examination, he found, to his great surprise, that his own name and address was written on it.

It had been sent by the „Nordstjernen" from Kristiania, and after the wreck of the vessel „the clever little box" had found its own way to its destination, which is a fanciful expression of the fact that winds and waves had carried it to the inner part of the Varanger Fiord.

Outside the prominent rocks of Finmarken, the tidal currents are very strong, the direction being easterly when the tide rises, and westerly during its fall.

I have had personal experience too of the strength of tidal currents. In the summer of 1894, in the course of a zoological expedition in Finmarken, I was out in a little boat on August 14th and had three men with me, I intended to pass Nordkyn going west. We had been sailing a little while, but the wind ceased and we were obliged to try to row; this was exactly opposite Nordkyn. The stream was, however, against us, and it proved to be utterly impossible for us to make any headway. Fortunately the water was so shallow just here that we were able to anchor until the current slackened.

That the tidal currents have a considerable carrying capacity, I have also noticed in Nygaardsstrømmen at Bergen, very near the Biological station. Not only large mussels but mediumsized specimens of a star-fish *(Asterias rubens)* now and then sail along with this current. So it is not strange that bottom forms, as for instance *Foraminifera*, are often found in plankton. Currents and winds play also an important part in the fact that plankton is heaped up in quantities at certain special places. A closer study of this subject will undoubtedly throw light on things connected with the catch of plankton-eaters, such as herrings, sprats etc.

Lately, it has become clear to me that the downfall plays an important part in the hydrography and biology of the fiords. My thoughts were first turned in this direction, when I noticed that an increase of salinity occurred in the fiords of northern Norway, from January and throughout the spring. In the fiords in the neighbourhood of Bergen too, I have seen that the surface salinity is greatest in the winter, as the downfall then is least and there is a portion which does not exert its influence for the time. One would then expect that the great difference in downfall in the west and north of Norway would be remarkably felt, and this is clearly shown to be the case.

A closer study of the downfall also gives an explanation of the fact that the deeper layers in the Porsanger Fiord have such a low temperature. According to Gran,[1]) Dr. Hjort found on the 24th of August 1900 the following conditions in Østerbotten, which is connected by a shallow channel with the rest of the Porsanger Fiord: —

d.	*t.*	*s.*
0 m.	7°.00 C.	under 32.00 ‰
20 „	4°.13 „	33.51 „
50 „	÷ 0°.07 „	34.24 „
90 „	÷ 1°.02 „	34.29 „

According to Mohn,[2]) the annual average temperature at Kistrand, which is in the inner part of the same fiord, is 0°.8 C.

[1]) Das Plankton des norwegischen Nordmeeres. Rep. Norw. Fish. and Marine Investigations, vol. II, nr. 5, 1902, p. 142.

[2]) Klimatabeller for Norge, I, p. 18.

The annual average downfall for the years 1896—1902 at Olderøen at the end of the Porsanger Fiord is reckoned to be 374 mm.[1]). In the years 1899 and 1900, the downfall for the different months was found to be as follows:[2]) —

Olderøen.
Downfall.

	1899 mm.	1900 mm.
January	18	16
February	22	15
March	25	28
April	12	2
May	11	5
June	2	24
July	62	94
August	30	69
September	11	23
October	20	17
November	32	67
December	10	49
Year	255	409

As a consequence of the slight downfall in the winter, the salinity of the surface layers constantly increases, and in this way there is a tendency to great regularity both in the temperature and salinity of the layers.[3]) But under these circumstances, the cooling of the surface by means of the vertical current will be felt far down, (Cf. Hydrography, p. 17) and the cold of the arctic winter will, in this way, penetrate down into the deeper layers. When the state of things is like that in Østerbotten, where a shallow channel effects the connection with the fiord, the warm under-currents cannot penetrate. Then too, the summer downfall is much more effective than that of the winter, so the mixing on the surface in the summer will serve to prevent the summer heat from penetrating downwards. Taken together, these things will, I think, explain Dr. Hjort's surprising statement of ÷ 1.02 at a depth of 90 mtrs. in Østerbotten, and will also give a clue to the fact that most of the arctic animals are found in the inner parts of the fiords. It should also be remembered that the longer a fiord is, the more will the continental influence be felt.

In western Norway, a different state of things is found in such shut-in basins as Østerbotten. I have studied conditions in the Lyse and the Mo Fiords, both of which belong to districts which form centres for the maximum downfall in Norway. At the station Nedrebø, in the Lyse river district, the average fall from 1896—1902 was 2 169 mm.; and at the station Farstveit, in the Mo river district, it was 2 733 during the same period.

I beg to refer to what I have recently written about these fiords.[4]) Now I will only mention that while the bottom water in Østerbotten contains degrees of cold from the winter, the bottom

[1]) Nedbøriagttagelser i Norge, aarg. VIII, 1902, p. 125.

[2]) Cf. Nedbøriagttagelser, aarg. V, VI.

[3]) Cf. Hydrogr. Tables nrs. 833—846.

[4]) Studier over naturforholdene i vestlandske fjorde. I. Hydrografi. Berg. Mus. Aarb., nr. 8, 1903.

water in the Mo and Lyse Fiords had a temperature corresponding to the average annual atmospheric temperature of the place. Also in the latter fiords, submarine ridges prevent the warm bottom water from penetrating in, and, moreover, the supply of fresh water in the winter is so great that the vertical current is prevented from assuming any large proportions. The transmission of heat downwards takes place principally by conduction. A maximum in the autumn and a minimum in the spring find their way gradually downwards, and finally an average is reached, which corresponds to the annual average atmospheric temperature.[1] The Skjerstad Fiord must probably be classed with the Mo and Lyse Fiords. The bottom water is homotermic (cf. Hydrography, p. 14), the supply of fresh water is sufficient to prevent the winter cold from penetrating down into the depths.

The station Sulitjelma, in the Vatnbygd river district, had an average fall of 1 097 mm. in the years 1896—1902, and the station Graddis, in the Salt river district, during the same period had an annual average of 533.[2] According to Mohn,[3] the annual average temperature at Bodø is 4°.1 C. and at Ranen 3.5. On August 17th 1877, the Norwegian North Atlantic Expedition found that the temperature in the Skjerstad Fiord at a depth of about 500 mtrs. was 3.2. On April 4th 1900, I registered at the same depth 3°.15 C. If one now considers these two atmospheric averages, it would seem that 3.2 is a probable value for the annual average temperature of the air in the Skjerstad Fiord.

If we, however, imagine the large basin of the Skjerstad Fiord moved to the inner part of the Porsanger Fiord, and with the same connections with the latter as it now has with the Salten Fiord, we should certainly find that the bottom temperature would be considerably lower than that of the annual average of atmospheric temperature in the inner part of the Porsanger Fiord. For, from what has already been said, it will be seen that the supply of fresh water at the latter place is not sufficient to prevent an evening out of its salinity in the winter, thus allowing the winter cold to exert its influence on deeper layers of water.

In some of the lesser fiords adjacent to the Vest Fiord, I have also noticed that the bottom temperature has been lower than the annual average atmospheric temperature, which would imply that somewhat of the winter cold has found its way downwards.

Examples of this fact may be found in Rombaken, Skjomen, the Øgs Fiord etc. Such places excel in many arctic forms. These fiords have already been referred to, and I would call attention to what has been said about them in previous pages and also to Pl. 19, where the curves VI, VII, VIII represent the conditions of temperature in Skjomen, the Øgs and Skjerstad Fiords. The curves for Skjomen and the Øgs Fiord are especially characteristic on account of their slight bend, which is a sign of a uniform salinity.

The temperature curves for Tranødybet, the Tys Fiord and Oxsund are given so that comparisons may be made, (Pl. 19, curves I, II, IV, V), all the curves are very much bent in the upper layers, where there is great variation in salinity, but in the layers where there is uniform salinity they become almost a straight line. Curves III and IV, which represent the conditions of temperature in March 1899 in the sea off Røst and in the Tys Fiord, show plainly that a higher temperature prevails in the deeper layers in the fiords than in the corresponding depths in the Norwegian Sea. As I have already stated, the reason for this is to be found in the fact that such fiords as the Tys Fiord are of such a formation as excludes the arctic bottom water from the Norwegian Sea, but gives admittance to the warm Atlantic waters which fill the basins. Then too the fresh water which flows into the fiord from the land, is sufficiently large in quantity from the Bokn Fiord to the Vest Fiord to prevent the winter cold from penetrating downwards to any considerable depth.

There is another thing which one might suppose to be, to some extent, dependent upon the variation in downfall, I mean the height of the water on the coasts.

From „Vandstandsobservationer“, published by „den norske gradmaalingskommission“ I have on pl. 20 drawn some curves, which give the monthly average height of the water at Kabelvaag and Vardø in the years 1882, 1884 and 1885.

The measurements have been made with selfregistering instruments at 0, 1, 2, 3 etc. hours after the moon's culmination and from these results the average has been calculated. Taking it for granted that the 0 points have been unaltered, and that the instruments in other respects too have been quite reliable, one must be able, by help of the data thus obtained, to form a wellfounded opinion of the variations in the rise and fall of the water, in the course of the year, on the northern coasts. A glance at the curves (I—VI, Pl. 20), will show that there is at any rate one thing which cannot possibly be accidental, the curves show a definite tendency to a minimum in April. Similarly, too, a maximum can be arrived at for the months November—January, while the remaining variations suggest accidental causes.

On the same plate the curves representing the average monthly downfall at Svolvær, which is situated near Kabelvaag and Vardø, are given. Both these curves show a decrease during the first months of the year up to May, in which month the year's minimum downfall is reached. The Svolvær-curve shows a maximum in November, and the Vardø-curve in October. There is this point of resemblance between the water-heights and downfall curves, that they generally show a decrease during the first months of the year, respectively up to April and May, but it cannot at all be said that the decrease in heights is caused solely by the decrease in downfall. Of course the variations in downfall exert some influence on the height of the coast water, but as regards the north of Norway, it will easily be seen on comparing the curves that this influence is by no means sufficient to account for the great differences in height. It should be remembered that 1 cm. is taken as the unit for the height, and 1 mm. for the downfall curves.

At Svolvær, the amplitude of the curve representing the average, monthly downfall is 8.3 cm., the corresponding value at Vardø is 5.3 cm. The observations made of heights have not been so complete that it has been possible to calculate the normal average for each month, but on the basis of the amplitudes of the Kabelvaag and Vardø curves, we get: —

		Amplitude.			Amplitude.
Kabelvaag	1882	61 cm.	Vardø	1882	52 cm.
—	1884	60 „	—	1884	35 „
—	1885	45 „	—	1885	47 „

These figures show, with all desirable clearness, that the variations in the course of the year are so considerable, that they

[1]) Cf. Studier over naturforholdene i vestlandske fjorde, p. 46.

[2]) Cf. Nedbøriagttagelser i Norge, aarg. VIII, p. 125.

[3]) Klimatabeller for Norge I, p. 18.

can only in a slight degree be caused by the variations in downfall from one month to another. The principal cause must be looked for in another direction, and one naturally turns one's attention to the distribution of atmospheric pressure, which, as is well known, determines the motions in the air — atmospheric currents —.

Dr. ANDREAS HANSEN[1]) has called attention to the fact that the maximum atmospheric pressure in the spring and the minimum height of the water, and the minimum midwinter barometric altitude and the greatest height of the water are, practically speaking, correspondent.

Prof. MOHN[2]) in his meteorology, has given the atmospheric pressure curves at Stykkisholm, in Iceland, and Gjesvær, near the North Cape, and with respect to the course of these curves, he says that, on both sides of the Norwegian Sea, the atmospheric pressure is lowest in the winter and highest in May.

The lowest atmospheric pressure from January—May, we should expect to find somewhere in the Norwegian Sea, and this is seen to be the case from MOHN's chart (l. c. p. 173) where a minimum is given at the NE of Iceland. This minimum is maintained, according to Prof. O. PETTERSSON,[3]) by the upper layers of water in the Norwegian Sea giving off heat to the atmosphere.

At any rate, it appears to be certain that the distribution of the atmospheric pressure on land and sea during the winter causes such winds as help to sweep the water away from the coasts.

It is probable that the most important causes of the annual fluctuations in the height of the water on the northern coasts may be found in the different distribution of atmospheric pressure in summer and winter and the winds which are dependent upon this.

On pl. 21, I have given the down-fall curves for 1899 with crossed lines for the stations at Svolvær, Skomvær, Tromsø and Alten, and have based them upon „Nedbøriagttagelser" (Observations on Downfall) published by the Norwegian Meteorological Institute. Similarly, the normal curves for the same stations are given in straight lines for a period of observation from 13 to 29 years.

From these curves, it will be seen that, in a single year, there may be great divergence from the normal downfall.

It is evident that the fluctuations in the amount of downfall exert an influence on the temperature and salinity of the sea. By increasing the height of the water in the fiords, the downfall also has some influence in producing currents. In the chapter dealing with the cod fishery in Lofoten, I will try to prove that there is a correspondence between the fishery results and the variations in the distribution of atmospheric pressure, and will, in so doing, use the height of the downfall as a measure of the influence of the winds.

c. Biological Notes.

The problem of the vertical distribution of living beings has occupied many biologists. I will not here treat of it at length, but only mention a few facts.

As far back as 1835, MICHAEL SARS[4]) divided our seaweed belt into the following 4 zones: — (1) That of the *Balanus*, (2) that of the *Patella*, (3) of the corals, and (4) that of the *Laminaria*. The greater depths had at that time been so little examined, that SARS could not attempt any division of the life found there. Since 1835, however, this subject has occupied the attention of many, and several divisions have been made. But I will only give here the one I prefer. Dr. STUXBERG has, in his book „Evertebratfaunan i Sibiriens Ishaf", accepted the same division for the animals as F. R. KJELLMAN[5]) for algae, viz: —

(1) *The littoral zone.*

That part of the bottom, which is laid bare at low water, and which in Norwegian is called „fjæren".

(2) *The sublittoral zone.*

From low water mark to the lower limit for algae.

(3) *The elittoral zone.*

All that is below the lower limit for algae.

[1]) Skandinaviens Stigning. Norges Geol. Unders. Aarb. f. 1896—99.

[2]) Kristiania 1902.

[3]) Die hydrographischen Verhältnisse der oberen Wasserschichten des nördlichen Nordmeeres. Bihang t. K. Svenska Vet. Akad. Handlingar B. 23, afd. II, nr. 4.

[4]) Beskrivelser og Iagttagelser, p. VI.

[5]) SUXBERG refers to KJELLMAN's treatise: — Ueber die Algenvegetation des Murmanschen Meeres an der Westküste von Novaja Semlja und Waigatsch. Nova Acta Reg. Soc. Scient. Ups., Ser. III, vol. extra ordinem editum. Upsala 1877.

According to P. BOYE,[1]) the dividing line between the sublittoral and elittoral zones is fixed by KJELLMAN at a depth of about 40 m. in Bohuslen, and this figure seems to suit the conditions on the southwest coast of Norway too. „On the coasts of Nordland and Finmark", says M. FOSLIE in a letter to me, „algae may generally be found down to 40—50 m., but vegetation mostly occurs to a depth of only about 30 m."

With regard to the vertical distribution of animals, STUXBERG fixes the limit between the sublittoral and elittoral zones in the Siberian polar waters at 30—40 fathoms, but I think it is best to keep to the algologists' limit, for a large number of animals is found in the seaweed zone. As far as I know, Norwegian algologists have accepted KJELLMAN's division, and I would suggest that zoologists also should test its practicability for animals too. If it be necessary to have a finer division, MICHAEL SARS's zones should be given a new trial.

As algae vegetation only reaches down to a certain depth, the quantity will to some extent depend upon the inclination of the bottom. On a rock which forms an angle of 30° with the horizon, there will, other things being equal, be much more algae than if the rock were perpendicular. The space between the shore line and the lower algae limit, which may be called the growing area for algae, has a definite proportion to the angle of inclination. Here again the same remarks as on page 230 are applicable, and the same mathematical explanation stands good. It will be found that the growing areas are in inverse proportion to the sinus of the angles of inclination.

[1]) Bidrag til Kundskaben om Algevegetationen ved Norges Vestkyst, p. 3. Berg. Mus. Aarb. 1894—95. No. XVI.

Notes on the animal life in some of the fiords examined.

In the small fiords surrounding Sandhornø, a few dredgings were made, and the result was so far satisfactory as to enable us to form an opinion of the character of the animal life in these fiords. Of annelides, the following were noticed: — *Harmothoë impar, Lepidonotus cirrosus, Phyllodoce maculata, Nephthys ciliata, N. cocca, Onuphis conchylega, Leodice norvegica, Arenicola marina, Potamilla neglecta, Filigrana implexa, Sternaspis fossor.* In „fjæren" near Sund farm, several specimens of *Echiurus pallasi* were taken.

Of echinoderms[1]) were taken e. g. *Ctenodiscus crispatus* and *Solaster syrtensis*, and of brachiopods and molluscs: — *Terebratulina caput serpentis, T. septentrionalis, Pecten islandicus, P. septemradiatus, Modiolaria lævigata, Leda minuta, Portlandia tenuis, P. lenticula, Arca pectunculoides, Cardium fasciatum, C. minimum, Astarte banksi, A. sulcata, A. compressa, Neæra arctica, N. obesa, N. obesa var. glacialis, Saxicava arctica, Zirphæa crispata, Margarita groenlandica, Machæroplax obscura, Trochus occidentalis, Amauropsis islandica, Natica affinis, Admete viridula, Bela declivis, B. rugulata, B. tenuicostata, Typhlomangelia nivalis, Trophon clatratus var. gunneri, T. barvicensis, Buccinum undatum, Neptunea despecta, Amphisphyra globosa, A. hiemalis.* Of *Amphipoda* may be mentioned: — *Lepidepecreum umbo, Ampelisca eschrichti, Paroediceros propinqvus, Aceros phyllonyx, Parapleustes latipes, Acanthonotosoma serratum, Syrhoë crenulata.* Of *Decapoda:* — *Pandalus annulicornis, P. borealis, P. brevirostris, Crangon almani, Pontophilus norvegicus, Sabinea septemcarinata, S. septemcarinata* var. *sarsi, Hippolyte gaimardi, H. spinus, H. lilljeborgi, H. polaris, Eupagurus pubescens, Galathea dispersa, Munida rugosa.* Of fish in these small fiords, the following were taken: — *Centridermichthys uncinatus, Drepanopsetta platessoides* and *Lumpenus lampretiformis.* Especially characteristic for the fiord between Sandhornø and Gildeskaal was the large number of *Decapoda.* There was a good fishing place for *Sebastes marinus* in the fiord. There are several boreal forms among the above mentioned animals, but a more thorough examination than I was able to make would probably show that the arctic forms are in the majority.

The Skjerstad Fiord has a fauna which corresponds to that of the fiords surrounding Sandhornø. There too, we made several hauls so that we got a more perfect result. Of *Coelenterata* which were noticed the following may be mentioned: —

Lucernaria qvadricornis, Alcyonium digitatum, Paraspongodes fruticosa, Cladiscus gracilis, Paraedwardsia arenarea, Actinostola callosa. Of *Echinodermata:* — *Antedon tenella, Ophiura robusta Ctenodiscus crispatus, Psilaster andromeda, Hippasterias phrygiana' Solaster papposus, Asterias mülleri, Strongylocentrotus droebachiensis' Spatangus purpureus* etc. Of *Polychæta:* — *Harmothoë impar, H. oerstedi, Leanira tetragona, Eumida sanguinea, Glyceria capitata, Onuphis conchylega, Nereis pelagica, Leodice norvegica, Brada villosa, Eumenia crassa, Nicomache lumbricalis, Pectinaria hyberborea, Maldane biceps, Terebellides strömi, Telepus circinnatus, Potamilla neglecta.* Of Brachiopods and Mollusks were observed: — *Waldheimia cranium, Terebratulina septentrionalis, Anomia aculeata, Pecten islandicus, P. vitreus, Nucula tumidula, N. tenuis, Leda pernula, L. minuta, Portlandia lucida, P. tenuis, P. lenticula, Arca pectunculoides, Cardium fasciatum, C. minimum, Astarte banksi, A. crenata, Axinus flexuosus, A. croulinensis, Neæra arctica, N. subtorta, N. cuspidata, Saxicava arctica, Dentalium entale, Siphonodentalium vitreum, Tectura virginea, Lepeta cocca, Puncturella noachina, Natica affinis, Littorina rudis, Rissoa jeffreysi, Scalaria groenlandica* (s), *Admete viridula, Bela rugulata, B. trevellyana, B. tenuicostata, Typhlomangelia nivalis, Trophon barvicensis, Buccinum undatum, B. finmarchianum* (?). *Neptunea despecta, Sipho ebur* (s), *Cylichna alba, Philine quadrata, Philine finmarchica, Dendronotus robustus, Campespe major, Coryphella rufibranchialis, C. nordgaardi.*

Amphipoda: — *Ambasia danielseni, Calisoma crenata, Tryphosa höringi, Paraphoxus oculatus, Ampelisca eschrichti, Stegocephalus similis, Metopa alderi, Monoculodes longirostris, Aceros phyllonyx, Paramphitoë pulchella, Parapleustes latipes, Syrrhoë crenulata, Rhacotropis helleri, R. macropus, Haliragès fulvocinctus, Melita dentata, Ischyrocerus minutus, Æginella spinosa.*

Isopoda: — *Munnopsis typica, Eurycope cornuta.*

Schizopoda: — *Boreomysis tridens, Erythrops goësi, E. abyssorum, Amblyops abbreviata, Mysideis insignis.*

Decapoda: — *Pasiphæa tarda, Pandalus annulicornis, P. borealis, Sclerocrangon boreas, Pontophilus norvegicus, Sabinea septem carinata, Hippolyte gaimardi, H. spinus, H. lilljeborgi, H. polaris, Eupagurus pubescens, Hyas araneus, H. coarctatus.*

Monascidia: — *Polycarpa libera.*

In the Skjerstad Fiord, as already mentioned, the warm, salt bottom water ($t = 6—7^{\circ}$, $s =$ about 35 ‰) cannot penetrate, or at any rate not in sufficient quantity to have any dominating influence on the natural conditions in the fiord. Here too, however, boreal forms occur in no small numbers, although arctic forms are undoubtedly found in much larger numbers than boreal ones. And when one finds that the fiord contains such forms as *Potamilla neglecta, Neæra arctica, N. subtorta, Siphonodentalium vitreum, Philine finmarchica, Campespe major, Sclerocrangon boreas, Polycarpa libera* etc., there is reason to conclude that the fauna of the Skjerstad Fiord is predominantly arctic.

The same must also be said of Skjomen, the Kanstad Fiord (cf. Hydrography, p. 20).

I will not give any detailed list of the forms noticed in these latter fiords, but only mention that in the Ogs Fiord were found, amongst others, *Ctenodiscus crispatus, Pectinaria hyperborea, Acanthozone cuspidata*, in the Kanstad Fiord *Asterias lincki* was found and in the Kirk Fiord, *Clymenia praetermissa, Eteone depressa, Defrancia lucernaria* etc.

On the other hand, it has been proved that in those fiords, or parts of fiords, where the ocean water has free access ($t = 6—7^{\circ}$ C., $s =$ about 35 ‰) the fauna in the deep water is predominantly boreal. (Cf. Hydrography, p. 19). With respect to the Vest Fiord, Professor G. O. Sars[1]) many years ago called attention to the fact that in the littoral and sublittoral zones some characteristic arctic animal forms certainly do occur, while the fauna in the deep water is southern in its character, and corresponds in most respects to the fauna on the west coast of Norway.

By the aid of the material which has been obtained by hydrographical research in recent years, we are now able to explain the reason for this state of things. On the surface, the warm current, which flows northwards, makes itself most felt on the outer coast, but its influence decreases the further one goes in the fiords. But,

[1]) *Asterias rubens* occurred in monstrous size. One of those we took had thrown its arms around a *Cyprina islandica*, which was half sucked out.

[1]) Nogle Bemerkninger om den Marine Faunas Karakter ved Norges nordlige Kyster. Tromsø Museums Aarshefter, II. Tromsø, 1879.

on the contrary with regard to the warm bottom water, which is almost independent of continental factors, and which, therefore, can retain its properties almost unchanged during its course in the fiords.

And the observations made have shown that the temperature and salinity of the bottom water in the Vest Fiord differs only very slightly from that of the fiords on the west coast of Norway.[1]) The similarity in fauna which the zoological examinations have brought to light are thus quite natural. As the Vest Fiord is the last of the large fiords which has bottom water with a temperature of 6—7° C. and a salinity of about 35 pro mille, it is also natural that it forms the northern limit for many boreal and lusitanic forms. Many southern forms are also found in Malangen, but the arctic species are doubtless in the majority there, and this is still more certainly the case in the Bals Fiord, the Ulfs Fiord, Lyngen and Kvænangen. As Malangen, hydrographically speaking, takes the position of a kind of transition fiord, I will mention some of the animal forms we dredged there.

Polychæta: — *Harmothoë rarispina, H. nodosa, H. asperrima, Lepidonotus amondseni, Laetmonice filicornis, Leanira tetragona, Nephtys incisa, N. ciliata, Leodica norvegica, Brada granulosa, B. granulata, Euphrosyne borealis, Nicomache lumbricalis, Pectinaria koreni, Terebellides strömi, Sabella pavonia.*

Of *Bryozoa*, there are two very characteristic boreal species which have their northern limit in Malangen, namely, *Kinetoskias smitti* and *Domopora stellata.*

Amphipoda:[2]) — *Hyale nilsoni, Socarnes vahli, Hippomedon propinqvus, Orchomenella minuta, O. penguis, Tryphosa höringi, Anonyx nugax, Lepidepecreum umbo, Leptophoxus falcatus, Harpinia neglecta, H. serrata, Ampelisca macrocephala, A. eschrichti, A. aequicornis, A. amblyops, Byblis gaimardi, Haploops tubicola, Stegocephalus inflatus, S. similis, Andania abyssi, Amphilocus tenuimanus, Stenothoë brevicornis, Metopa borealis, M. bruzeli, Leucothoë spinicarpa, Paroediceros lynceus, P. propinqvus, Monoculodes borealis, M. tessellatus, M. latimanus, M. longirostris, M. packardi, Halimedon megalops, H. brevicalcar, Bathymedon obtusifrons, Aceros phyllonyx, Pleustes panoplus, Paramphitoë assimilis, Ephimeria tuberculata, E. loricata, Acanthonotosoma serratum, Iphimedia obesa, Syrrhoë crenulata, Tiron acanthurus, Ensirus minutus, Rhacotropis helleri, Halirages fulvocinctus, Apherusa bispinosa, A. tridentata, Calliopius laeviusculus, Dexamine spinosa, D. thea, Melphidipha borealis, Gammarus locusta, Melita dentata, Lilljeborgia pallida, L. fissicornis, Protomedeia fasciata, Gammaropsis melanops, Amphitoë rubricata, Ischyrocerus angripes, Corophium crassicorne, Unciola planipes, Dulichia sp., Phtisica marina, Æginella spinosa, Caprella linearis.*

Sparre Schneider had no opportunity to examine the greatest depth of Malangen, so our dredgings form a suitable supplement to Schneider's investigations. We brought to light 18 species of amphipods, which were new to the Malangen fauna, and most of these were from the great depth where, as above mentioned, Schneider did not make any dredgings. There are several boreal forms among the amphipods mentioned, but the arctic ones are however, in a small majority. *Epimeria tuberculata*, which is a

[1]) Cf. Nordgaard, Studier over naturforholdene i vestlandske fjorde, I, Hydrografi. Berg. Mus. Aarb. 1903, nr. 8, p. 32.

[2]) Here I have also included the amphipods which were found in Malangen by Sparre Schneider. Cf. Malangenfjordens fauna. Tromsø Mus. Aarsh. 14, 1891.

boreal form, has its northern limit in Malangen and *Epimeria loricata*, which is an arctic one, has here its southern limit. Of *Cumacea*, I found for instance *Diastylis goodsiri*, which is a decided arctic form. It was new to Malangen, which is the southern limit for the species on our coast.

Schizopoda: — *Boreophausia inermis, Boreomysis arctica, B. tridens, Pseudomma roseum, Mysideis insignis, Mysis mixta.*

Boreomysis tridens has not been found north of Malangen.

Decapoda: — *Pasiphæa tarda, Pandalus annulicornis, P. propinqvus, P. brevirostris, Crangon almani, Pontophilus norvegicus, Sabinea septemcarinata, S. septemcarinata* var. *sarsi, Hippolyte spinus, H. lilljeborgi, H. polaris, Bythocaris simplicirostris, Eupagurus pubescens, Lithodes maja, Munida rugosa, Hyas courctatus.* Of those mentioned, both *Pandalus propinqvus* and *brevirostris* have here their northern limit. Respecting the fauna of Malangen, I refer to the mentioned paper by Sparre Schneider. With the exception of the amphipods, I have here only mentioned the forms which I personally observed in the fiord.

Brachiopods and molluscs have long been considered to be useful in forming a precise picture of the zoogeographical character of a given district. I will therefore arrange these animals in a table, based upon the examinations which have been made by Sparre Schneider[1]), the Norwegian North Atlantic Expedition[2]), C. W. S. Aurivillius[3]), Johan Hjort[4]), A. M. Norman[5]), G. O. Sars[6]) and myself.

[1]) Kvænangens Molluskfauna, Malangenfjordens fauna. Tromsö Mus. Aarsh. 14, 1891.

[2]) Herman Friele & James A. Grieg. Mollusca III.

[3]) Hafsevertebrater från nordligaste Tromsö amt och Vestfinmarken. Bihang til Kgl. Sv. Vet. Akad. Handl. 11, No. 4.

[4]) Herman Friele, Mollusken der ersten Nordmeerfahrt des Fischereidampfers „Michael Sars" 1900 unter Leitung von Herrn Dr. Johan Hjort. Berg. Mus. Aarb. 1902, Nr. 3.

[5]) Notes on the Natural History of East Finmark.

[6]) Mollusca regionis arcticae Norvegiae.

Brachiopoda and *Mollusca*	Malangen	Kvænangen	East Finmark Fiords
Brachiopoda.			
Rhynchonella psittacea, Chemn.	+	+	+
Terebratulina caput serpentis, Lin.	+	+	..
T. septentrionalis, Couth	..	..	+
Waldheimia cranium, O. F. Müll.	+	+	+
Pelecypoda.			
Anomia ephippium, Lin.	+	+	+
A. aculeata, Müll.	+	+	+
Pecten islandicus, O. F. Müll.	+	+	+
P. septemradiatus, O. F. Müll.	+	..	..
P. tigrinus, O. F. Müll.	..	+	+
P. striatus, O. F. Müll.	+	+	..
P. vitreus, Chemn.	+	+	..
P. abyssorum, Lov.	+	+	..
P. imbrifer, Lov.	+	+	+
P. groenlandicus, Sow.	..	+	+
Mytilus edulis, Lin.	+	+	+
Modiola modiolus, Lin.	+	+	+
M. phaseolina, Phil.	+	+	+

Pelecypoda.

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Modiolaria discors, Lin.	+	+	+
M. lævigata, Gray	+	+	+
M. corrugata, Stimps.	..	+	+
M. nigra, Gray	+	+	+
Dacrydium vitreum, Møll.	+	..	+
Crenella decussata, Mont.	+	+	+
Nucula tenuis, Mont.	+	+	+
N. delphinodonta, Migh.	..	+	+
Leda pernula, Müll.	+	+	+
L. minuta, O. F. Müll.	+	+	+
Portlandia lucida, Lov.	+	+	+
P. intermedia, M. Sars	..	..	+
P. lenticula, Fabr.	+	+	+
P. frigida, Torell	..	..	+
Yoldia limatula, Say	+	+	+
Arca pectunculoides, Schacchi	+	..	..
A. p. var. septentrionalis, G. O. Sars	+	+	+
A. glacialis, Gray	..	..	+
Limopsis minuta, Phil.	..	..	+
Cardium echinatum, Lin.	+	+	..
C. edule, Lin.	.	+	
C. ciliatum, Fabr.	..	..	+
C. fasciatum, Mont.	+	+	+
C. minimum, Phil.	+	+	..
Serripes groenlandica, Lin.	..	..	+
Cyprina islandica, Lin.	+	+	+
Astarte borealis, Chemn.	+	+	+
A. banksi, Leach.	+	+	+
A. sulcata, da Costa	+	..	..
A. compressa, Lin.	+	+	+
A. crenata, Gray	+	+	+
Venus gallina, Lin.	+	+	+
V. ovata, Penn.	+	+	+
Lucina borealis, Lin.	+	..	..
Axinus flexuosa, Mont.	+	+	+
A. sarsi, Phil.	+	+	+
A. gouldi, Phil.	+	+	+
A. obesus, Verr.	..	..	+
Axinopsis orbiculata, G. O. Sars	+	..	+
Cyamium minutum, Fabr.	+	+	+
Kellia suborbicularis, Mont.	+	..	..
Montacuta bidentata, Mont.	+	..	..
M. maltzani, Verk.	..	..	+
Mactra elliptica, Brown	+	..	+
M. subtruncata, da Costa	+	..	+
Syndosmya nitida, Müll.	+	..	..
Tellina calcarea, Chemn.	+	+	+
T. balthica, Lin.	+	+	+
T. fabula, Gronov.	+	..	..
Solen pellucidus, Penn.	+	..	..
Thracia truncata, Brown	+	+	+
Neæra arctica, M. Sars	..	..	+
N. obesa, Lov.	+	+	+
N. obesa, var. *glacialis*, G. O. Sars	..	..	+
N. subtorta, G. O. Sars	+	+	+
Poromya granulata, Nyst	+	..	+
Corbula gibba, Olivi	+	..	+
Mya arenaria, Lin.	+	+	+
M. truncata, Lin.	+	+	+
Panopea norvegica, Spengl.	+	+	+
Saxicava arctica, Lin.	+	+	+

Scaphopoda.

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Dentalium entalis, Lin.	+	+	+
D. occidentale, Stimps.	+	+	..
Siphonodentalium vitreum, M. Sars	+	+	+

Placophora.

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Hanleyia hanleyi, Bean	+	+	
Leptochiton cancellatus, Sow.	..	+	..
L. arcticus, G. O. Sars	..	+	+
L. cinereus, Lin.	+	+	..
Trachydermon albus, Lin	+	+	+
T. ruber, Lowe	+	+	+
Tonicella marmorea, Fabr.	+	+	+

Gastropoda.

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Patina pellucida, Lin.	..	..	
Acmæa testudinalis, Müll	+	+	..
Tectura rubella, Fabr.	..	..	
T. virginea, Müll.	+	+	+
T. fulva, O. F. Müll.	..	+	
Lepeta cocca, O. F. Müll.	+	+	+
Puncturella noachina, Lin.	+	+	+
Scissurella crispata, Flem.	..	..	
Mølleria costulata, Møll.	..	..	+
Cyclostrema pettersoni, Friele	..	..	+
Margarita helicina, Fabr.	+	+	+
M. groenlandica, Chemn.	+	+	+
M. cinerea, Couth.	+	+	+
M. olivacea, Brown	+	+	+
Machæroplax obscura, Couth.	+	+	+
M. varicosa, Migh.	..	..	+
Gibbula cineraria, Lin.	+	+	
G. tumida, Mont.	+	+	+
Trochus occidentalis, Migh.	+	+	+
Velutina lævigata, Penn.	+	+	+
V. lanigera, Møll.	..	..	+
V. zonata, Gould.	..	..	+
V. flexilis, Mont.	..	..	+
V. cryptospira, Midd.	..	..	+
Lamellaria latens, O. F. Müll.	..	+	..
Marsenia prodita, Lov.	..	..	+
M. micromphala, Bergh	..	..	+
M. groenlandica, Møll.	..	..	+
Onchidiopsis glacialis, M. Sars	..	+	+
Ampullina smithi, Brown	..	+	+
Amauropsis islandica, Gmel.	+	+	+
Natica (Lunatia) groenlandica, Beck	+	+	+
N. (Lunatia) montagui, Forb.	+	..	+
N. (Lunatia) nana, Møll.	..	..	+
N. affinis, Gmel.	+	+	+
Trichotropis borealis, Brod. & Sow.	+	+	+
T. conica, Møll.	..	+	+
Littorina littorea, Lin.	+	+	+
L. rudis var. *groenlandica*, Møll.	+	+	+
L. palliata, Say.	+	+	+
L. obtusata, Lin.	..	..	+
Lacuna pallidula, da Costa	..	+	+
L. divaricata, Fabr.	+	+	+
Hydrobia minuta, Totten	..	+	+
H. ulvæ, Penn.	+	..	..
Onoba striata, Mont.	..	+	..

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Gastropoda.			
Onoba aculeus, Gould	+	..	+
Cingula castanea, Møll	..	..	+
C. tumidula, G. O. Sars	..	..	+
Alvania jeffreysi, Waller	..	..	+
A. jan mayeni, Friele	..	..	+
Rissoa parva, da Costa	+	..	..
R. parva, var. *interrupta*, Adams	..	..	+
R. inconspicua, Ald	+	..	..
Skenea planorbis, Fabr	..	..	+
Jeffreysia globularis, Jeff	..	..	+
Turritellopsis acicula, Stimps	..	..	+
Lovenella metula, Lov	..	..	+
Cerithiopsis costulata, Møll	..	..	+
Læocochlis granosa, Wood	..	..	+
Scalaria groenlandica, Chemn	+	+	+
S. obtusicostata, S. Wood	..	..	+
Parthenia eximia, Jeff	..	..	+
P. spiralis, Mont	..	..	+
Odostomia unidentata, Mont	..	+	+
O. turrita, Hanley	..	..	+ (s)
Auriculina insculpta, Mont	+	+	..
Liostomia eburnea, Stimps	..	..	+
Eulima bilineata, Alder	..	..	+
E. stenostoma, Jeff	..	..	+
Homalogyra atomus, Phil	..	..	+
Admeta viridula, Fabr	+	+	+
Taranis cirrata, Brug	..	+	+
Mangilia (Teretia) amæna, G. O. Sars	..	..	+
M. (Thesbia) nana, Lov	+	..	+
Bela pyramidalis, Strøm	+	+	+
B. pingeli, Beck	+	..	+
B. cancellata, Migh	+	+	+
B. obliqua, Møll	+	+	+
B. cinerea, Møll	..	+	+
B. nobilis, Møll	..	+	+
B. scalaris, Møll	+	+	+
B. rugulata, Trosch	+	+	+
B. exarata, Møll	—	+	+
B. harpularia, Couth	+	+	+
B. trevelyana, Turt	+	+	+
B. decussata, Couth	+	+	+
B. tenuicostata, M. Sars	..	..	+
B. bicarinata, var. *violacea*, Migh	+	+	+
B. kobelti, Verk	..	..	+
B. simplex, Midd	..	..	+
B. sarsi, Verr	..	..	+
Typhlomangelia nivalis, Lov	+	+	+
Spirotropis carinata, Phil	+	..	+
Metzgeria alba, Jeff	+	..	..
Trophon truncatus, Strøm	..	+	+
T. clathratus, Lin	+	+	+
T. barvicensis, Johnst	+ (s)	..	+
Purpura lapillus, Lin	+	+	+
Astyris rosacea, Gould	+	+	+
Nassa incrassata, Strøm	..	..	+
Buccinum undatum, Lin	+	+	+
B. groenlandicum, Chemn	..	+	+
B. undulatum, Møll	..	+	+
B. finmarchianum, Verk	..	+	+
B. hydrophanum, Hancock	..	..	+
B. humphreysianum, Ben	..	..	+
Neptunea despecta, Lin	+	+	+

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Gastropoda.			
Volutopsis norvegica, Chemn	..	+	+
Ukko turtoni, Bean	..	+	+
Sipho islandicus, Chemn	..	+	+
S. gracilis, da Costa, var. *glaber*, Verkr	+	..	+
S. turritus, M. Sars	..	+	+
S. lachesis, Mørch	..	..	+
S. verkrüzeni, Kobelt	..	..	+
S. latericeus, Møll	..	+ (s)	+
S. ebur, Mørch	+	..	+
S. fusiformis, Brod	..	..	+
Boreofusus berniciensis, King	..	..	+
Acera bullata, Müll	+	+	+
Cylichna alba, Brown	+	+	+
C. propinqua, M. Sars	+	+	+
Tornatina nitidula, Lov	+	..	..
Utriculus truncatulus, Brug	+	..	..
U. pertenuis, Migh	..	..	+
Amphisphyra hyalina, Turt	+	..	+
A. hiemalis, Couth	..	+	+
Scaphander puncto-striatus, Migh	+	+	+
Philine scabra, Müll	..	+	..
P. finmarchica, M. Sars	..	+	+
P. fragilis, G. O. Sars	..	..	+
P. quadrata, S. Wood	+	..	+
P. lima, Brown	+	+	+
Nudibranchiata.			
Doris obvelata, O. F. Müll	..	+	+
Lamellidoris bilamellata, Lin	..	..	+
L. muricata, O. F. Müll	..	..	+
Acanthodoris pilosa, O. F. Müll	..	..	+
Triopa lacer, O. F. Müll	..	..	+
Dendronotus frondosus, Asc	..	..	+
D. robustus, Verr	..	..	+
Æolida papillosa, Lin	..	..	+
Æ. pusilla, Friele	..	+	..
Coryphella rufibranchialis, Johnst	..	+	..
C. sarsi, Friele	..	..	+
Limapontia capitata, O. F. Müll	..	..	+

From these tables, it will be seen that Malangen, Kvænangen and the fiords of East Finmark for the most part have the same molluscs. It is probable that further investigation would show a still greater similarity than that found in the tables. It may, however, with certainty be affirmed, that there are more boreal forms in Malangen and Kvænangen than in the East Finmark fiords, in the latter there are, on the other hand, more arctic species. The warm current which flows northwards also exerts some influence in East Finmark. On $^{28}/_{4}$ 1899, at the mouth of the Porsanger Fiord, at a depth of 250 mtrs., I registered 2°.75 C. (p. 8), which proved that a comparatively warm current was seeking to penetrate at the bottom. The temperature at a depth of 200 mtrs. was 1.3 and salinity 34.54.

According to Gran, on Aug. 28th 1900, at the mouth of the Porsanger Fiord, the following conditions were registered from „Michael Sars“: —

Depth:	—	0	20	60	100	200	m.
Temp.:	—	6.6	6.2	6.2	5.8	3.8	„
Sal.:	—	33.56	34.28	34.36	34.44	34.89	„

A little farther in the fiord, *Limopsis minuta*, Phil., which is a boreal form, was taken, according to Friele.

In the Tana and Varanger Fiords, such comparatively high temperatures at the bottom as 2.8 and 3.1 (p. 20) have also been registered. So that one must not expect to find an altogether unmixed arctic fauna in East Finmark either, although the arctic forms are greatly in the majority. Such species as *Pecten tigrinus*, *Venus ovata* and *gallina*, *Dentalium entalis*, *Patina pellucida*, *Gibbula cineraria* and *tumida*, *Natica montagui* etc. must be considered to be decided boreal forms, and yet they have pushed their way up to East Finmark.

Professor G. O. Sars has found several boreal forms at Hasvik in Sørø. This place has not been hydrographically investigated, but I am inclined to think that the deep channel, which penetrates in from the ocean along the island, has comparatively warm water at the bottom. Another stopping place for boreal forms is the Malangen, where the bottom temperature at the greatest depths varies between 4 and 5°.5 C., but the Vest Fiord is the most definite limit for marine fauna on the Norwegian coast, a very large number of boreal animal forms being found here, but not further north. It is interesting to be able to connect this fact with the one that the Vest Fiord is the most northerly of the large Norwegian fiords in which ocean water dominates the natural conditions at the depths ($t = 6-7°$, $s =$ ca. 35 ‰). As a general zoogeographical result, it may be stated that, with respect to the large important fiords, which are open to the ocean, the lusitanic and boreal forms occur as far up as the Vest Fiord in larger numbers than the arctic ones. It is first in the Malangen that the arctic forms are in the majority, and this even more noticeable in the Kvænangen and Porsanger Fiords, the latter having almost unmixed arctic fauna. The inner parts of the fiords and the branch fiords have retained more of the arctic species. For instance, while in the Salten Fiord, the southern forms are in the majority, we find that in the Skjerstad Fiord, which lies further inland, and in the Beier Fiord which is a little farther south, the arctic animals are more profuse than the southern ones. The Ranen Fiord has not yet been investigated, but it is probable that also there arctic forms will be predominant.

Generally speaking, these facts coincide with the opinion expressed long ago by Prof. G. O. Sars.[1]) What I have tried to adduce is the connection between zoogeographical and hydrographical limits.

The northernmost *Lophohelia* reef, hitherto known.

In his description of *Ophiacantha spectabilis*, G. O. Sars[2]) says: — „I have found this important species at one place only, namely near Bodø, where it is not so very scarce between the corals *(Lophohelia prolifera)*, which are abundant at a depth of from 80—100 fathoms. It is generally so firmly attached to the tangled branches of the corals, by means of its spiked arms, that it is exceedingly difficult to get it loose.“ On June 19th 1878, the Norw. North Atl. Exp. took two specimens of this echinoderm at st. 255 in the Vest Fiord (68° 12′ N., 15° 40′ E.). The depth is given as being 624 mtrs., temperature 6.5 and the bottom material, clay.

About the same time, *O. spectabilis* was found by V. Storm in the outer part of the Trondhjem Fiord. In a paper written in recent years Storm[1]) says that this species occurs in large quantities on *Lophohelia prolifera* in the outer part of the Trondhjem Fiord. According to Grieg,[2]) also Hoyle has mentioned the species from the Faeroe Channel (433 fathoms). I do not know if *Lophohelia prolifera* is found at the latter place, but it is very probable, for M. Sars[3]) mentions that it is found off the Shetland Isles. Verrill[4]) too mentions *spectabilis* as found off Nova Scotia, 1883, 131 fathoms, one specimen. Nothing is said about *O. spectabilis* having been found together with *Lophohelia prolifera*, but in another place, Verrill writes (l. c. p. 536): „*L. prolifera* B. range, 100 to 300 fathoms, off Nova Scotia; 1060 fathoms, dead, 1884, rare.“ There is thus probably nothing which makes it unlikely that the ophiurid in question may have been attached to the coral here mentioned.

When working out my material of echinoderms, Grieg[5]) mentions that Koehler has given *O. spectabilis* as being found in the Bay of Biscay, but as Koehler's specimens appear to be somewhat different to Sars's species, Grieg raises doubt as to their identity. The following table gives some important data concerning the places where I have found *spectabilis*.

O. spectabilis, G. O. Sars.

Date	Place	Lat. & Long.	Dredged between m.	Depth of water sample m.	Temp. C.	Salin. cont.	Bottom.
16/3 1899	Tranødybet	68° 15′.5 N. 15° 49′.0 E.	450—530	500	6°.3	35.06	*Lophohelia*
28/3 1899	The Tys Fiord I	68° 12′.5 N. 16° 12′.5 E.	500—600	500	6°.3	35.11	*Lophohelia*
30/3 1900	Arnø	67° 11′ N. 14° 0′ E.	300—400	400	6°.55	35.18	*Lophohelia*

Arnø is situated outside the mouth of the Salten Fiord near Bodø, and Tranødybet is a little farther in than st. 255 of the Norw. North Atl. Exp. in the Vest Fiord, the bottom here is given as being of clay, but there has probably been a hard spot which is accounted for by the presence of *Lophohelia*, which was the case in Tranødybet.

There is thus reason to conclude that *O. spectabilis* is so closely connected with *Lophohelia prolifera* as to make the latter almost a necessity for the former. This does not, however, at all imply that where ever *Lophohelia* occurs, *O. spectabilis* is also found. This is an interesting instance of one animal's dependence upon another,

[1]) Nogle bemerkninger om den marine faunas karakter ved Norges nordlige kyster. Tromsø Mus. Aarsh., II, 1879.

[2]) Nye Echinodermer fra den norske Kyst. Sep., p. 12. Kristiania Vid. Selsk. Forh. 1871.

[1]) Oversigt over Trondhjemsfjordens fauna. Beretning fra arbeidskomitéen for Trondhjems biologiske station 1900.

[2]) Ophiuroidea, p. 24. The Norw. North Atl. Exp.

[3]) Fossile dyrelevninger fra Quartærperioden, p. 92.

[4]) Results of the Explorations made by the steamer Albatross. Ann. Rep. of the Comm. of Fish and Fishery for 1883.

[5]) Oversigt over det nordlige Norges echinodermer. Berg. Mus. Aarb. 1902, no. 1, p. 14.

and it will be interesting to see what other animals exist together with *Lophohelia.* But first I will mention a few facts about the coral itself. This easily recognized species has been found in several of the fiords on the west coast of Norway up to the Vest Fiord, in rather deep water (about 150—500 m.). As far as I know, my specimens have been taken at the most northerly place for this species (Tranødybet, the Tys Fiord I). And I am inclined to think that no living specimens will be found farther north, as the colonies live on our coast under unusually uniform and settled natural conditions, with a temperature of 6—7° C. and a salinity of about 35 ‰. There is reason for supposing that at VERRILL's locality „off Nova Scotia" the conditions are similar. At any rate, VERRILL (l. c. p. 506) mentions that off Cape Sable the temperature, at a depth of 65—131 fathoms, varies between 42° and 46° Fhr. (5°.5—8° C.). Cf. stations nr. 2065—2071. The bottom at a couple of these stations is given as being of coral. It is, therefore, probable that the temperature here too is near 6—7° C. at those places where *Lophohelia prolifera* occurs alive. According to VERRILL, only dead specimens were taken at 1060 fathoms, and if it be remembered that in the Norwegian waters the coral in question does not extend beyond the boundary of the ocean water, it tempts me to conclude that the species cannot live at a depth of 1060 fathoms off Nova Scotia, notwithstanding that the fall in temperature is not particularly great. VERRILL (l. c. p. 503) says „The bottom temperatures between 1 000 and 2 000 fathoms were usually between 37° F. and 39° F., and rarely 40°." If *Lophohelia* from 1 060 fathoms had existed at this place under present natural conditions, it ought therefore also now to be able to thrive in a temperature of 3—4° C. But the investigations hitherto made in Norway seem to contradict this possibility. A couple of suggestions may be made to account for the occurrence of *Lophohelia* at such a great depth. The colonies may have been transported from some other locality, so that when the dredgings were made from the „Albatross" they were in a secondary layer, or a fall in the bottom level may have taken place. There are instances of a rise of the bottom in a couple of places in Norway where *Lophohelia* has been brought several meters higher than the present water level.

Prof. MICHAEL SARS[1]) was the first who discovered *Lophohelia prolifera* at a height of 30 meters above sea level, this was at Drøbak in the Kristiania Fiord, he paid great attention to this occurrence and gave a good description of it. Later on, more light has been thrown upon the subject by Prof. W. C. BRØGGER,[2]) who writes in part as follows: — „From the time of the deepest submergence of the Kristiania region, an epiglacial fauna is known, which has lived at a great depth, at least 150 meters. This is the famous dead coralreef at Drøbak, south of Kristiania, where the shore, from 60 meters below the sea-level to about 30 meters above it, is covered with the remnants of a great reef of *Lophohelia prolifera.*" BRØGGER also shows the height of the reef above the sea-level (30 m.) + the minimum depth of the coral in the present fiords (150 m.) answers to the upper marine boundary at Drøbak (180 m.) — „a proof, that the *Lophohelia*-reef was formed, partly at any rate, during the deepest submergence of the land at Drøbak." A similar argument holds good with regard to the other occurrence at Stenkjær at the end of the Trondhjem Fiord.

[1]) Fossile dyrelevninger fra quartærperioden, p. 76—77.

[2]) Om de senglaciale og postglaciale niveauforandringer i Kristianiafeltet. N. G. U. No. 31, p. 182—187, p. 689 (English Summary).

Natural conditions at the time when *Lophohelia* lived at Drøbak and Stenkjær cannot have been very different to what they are now in the deep western fiords, and it may from this be concluded that the Gulf Stream, at least from the epiglacial time, filled the channels and basins in the Norwegian fiords with its warm water.

Together with *Lophohelia,* M. SARS found various other characteristic forms, e. g. *Pecten vitreus, P. aratus, Lima excavata, Arca nodulosa* etc.

These animals very frequently follow *Lophohelia* in our fiords at the present day, but in no definite state of dependence. Further, the presence of these animals proves that the natural conditions in the depths of the fiords during the epiglacial time could not have been so very dissimilar to the present conditions. But, on the other hand, the deposits in the shallow waters plainly show that in the upper layers of water, quite a different state of things was prevalent to that of the present day.

It is interesting to give a list of the most important animals which have been observed together with *Lophohelia* at the most northern localities where this species has been found.

$^{30}/_{3}$ 1900, Arnø, 300—400 m.

Lophohelia prolifera, PALL., *Paramuricea placomus,* LIN., *Ophiacantha spectabilis,* G. O. SARS, *Flustra barleei,* BUSK, *Lima excavata,* FABR., *Lamellaria latens,* O. F. MÜLL., *Pandalus propinqvus,* G. O. SARS, *Pontophilus norvegicus,* M. SARS.

$^{16}/_{3}$ 1899, Tranødybet, 450—530 m.

Lophohelia prolifera, PALL., *Ophiacantha spectabilis,* G. O. SARS, *Pteraster militaris,* O. F. MÜLL., *Pandalus propinqvus,* G. O. SARS, *Hippolyte polaris,* SAB., *Galathodes tridentatus,* ESMARK.

$^{23}/_{3}$ 1899, The Tys Fiord I, about 500 m.

A sounding at the beginning of our dredging stated a depth of 725 m. and at the end 500 m. We drove along very quickly, however, and our line was hardly long enough, so that we got nothing from the clay at 725 m. It was first at the edge that the trawl began to take in anything, and when we drew it up from a depth of about 500 meters, the net was half full of living and dead branches of *Lophohelia,* on which was found: —

Pulvinulina punctulata, D'ORB.

There were also: —

Lophohelia prolifera, PALL., *Protanthea simplex,* CARLG., *Ophiacantha spectabilis,* G. O. SARS, *Ophioscolex glacialis,* MÜLL. and TROSCH., *O. purpureus,* DÜB. and KOR., *Pteraster militaris,* O. F. MÜLL., *Echinus elegans,* DÜB. and KOR., *Lineus cinereus,* PUNNETT, *Leodice norvegica,* LIN., *L. gunneri,* STORM, *Terebratulina caput-serpentis,* LIN., *Waldheimia cranium,* MÜLL., *Lima excavata,* FABR., *Pecten vitreus,* CHEMN., *Pleurobranchus plumula,* MONT., *Metopa alderi,* BATE, *Janira maculosa,* LEACH., *Pandalus propinqvus,* G. O. SARS, *Hippolyte polaris,* SAB., *Galathodes tridentatus,* ESMARK, *Munida rugosa,* G. O. SARS, *M. tenuimana,* G. O. SARS, *Ciona intestinalis,* LIN.

Some of the species mentioned have here their northern limit, e. g. *Protanthea simplex, Echinus elegans, Lima excavata, Galathodes tridendatus.* A wide distribution southwards has for instance *Galathodes tridentatus,* which, according to MILNE-EDWARDS and BOUVIER, extends right down to the west coast of Marocco, and *Lima excavata,* of which FRIELE and GRIEG write in their account of the Mollusca of the Norw. North Atlantic Exp.: — „It is also

known in the deep water between the Hebrides and the Faeroe Isles, in Portugal, the Azores and Senegambia."

From the investigations made by M. and G. O. Sars, as well as V. Storm, we have a tolerably complete knowledge of the fauna of the coral regions in our fiords. Storm has given a concise account of the conditions in the Trondhjem Fiord, with a map showing the position of the corals, and to this I would beg reference. I will here also emphasize the fact that the characteristic forms on the epiglacial *Lophohelia*-reef at Drøbak (*Pecten vitreus, P. aratus, Lima excavata, Arca nodulosa* etc.) also at the present time show themselves to be faithful companions. However, I do not think practical boundaries can be drawn between the fauna which are connected with *Lophohelia* and those which are connected with other corals, such as, *Paragorgia arborea, Paramuricea placomus* or *Primnoa lepadifera*.

It may, on the other hand, be said that the region of the deep water corals has its definite, decided fauna, which is particularly uniform in all the large Norwegian fiords to which the ocean water has free access, from the Bokn to the Vest Fiord. There is a coral facies of animals, just as there is a clay facies.

A few words on the fauna in clay.

The deep channels and basins in the fiords (150—200 m. and more), of which clay forms the bottom and into which the ocean water has access, have also their characteristic animal life.

And since the investigations made by G. O. Sars, in the sixties, at the fishing place Skroven and at other places in the Vest Fiord, we know that there are especially interesting forms on the clay-bottom of the depths. Such as, for instance, *Isidella hippuris, Ulocyathus arcticus, Rhizocrinus lofotensis, Brisinga coronata, Flustra abyssicola* etc. The fauna at Skroven, where I have made a very successful haul with a trawl at a depth of 350—410 m., is very rich. In addition to the forms just mentioned, it was quite usual to find such species as the following, on the clay depths in the Vest Fiord and those of its arms into which ocean water penetrates at the bottom: —

Foraminifera: — *Astrorhiza arenaria, Saccammina sphærica, Storthosphæra albida, Bathysifon filiformis, Rhabdammina abyssorum.*

Echinodermata: — *Amphilepis norvegica, Ophioscolex glacialis, Psilaster andromeda, Stichopus tremulus, Bathyplotes natans, Mesothuria intestinalis, Cucumaria hispida, Myriotrochus vitreus.*

Polychæta: — *Lætmonice filicornis, Leanira tetragona, Terrebellides strömi.*

Mollusca: — *Nucula tumidula, Portlandia lucida, Malletia obtusa, Arca pectunculoides, Limopsis minuta, Cardium minimum, Kelliella milliaris, Syndosmya*-species, *Neæra obesa, N. rostrata, Dentalium occidentale, D. agile, Siphonodentalium quinquangulare, Scaphander lignarius.*

Ostracoda: — *Cypridina norvegica.*

Isopoda: — *Munnopsis typica, Eurycope cornuta.*

Schizopoda: — *Boreomysis tridens, Pseudomma roseum.*

Decapoda: — *Pontophilus norvegicus, Munida rugosa, M. tenuimana.*

Ascidia: — *Ascidia gelatinosa.*

The above list gives some of the species which are constantly found on the clay at the bottom of rather deep water. Many of these forms are undoubtedly mud-eaters, more especially is this the case with regard to the above mentioned Holothurioidea. Some of them appear to be dependent upon ocean water (t = 6—7° C., s = about 35 ‰). According to Ostergren,[1] *Bathyplotes natans, Mesothuria intestinalis, Cucumaria hispida* and *Myriotrochus vitreus* are not found in Norwegian fiords further north than the Vest Fiord. It is characteristic that I took several specimens of *Bathyplotes natans* and *Mesothuria intestinalis* in the Salten Fiord where the temperature was 6°,65 C. and the salinity 35,13 ‰, while in the Skjerstad Fiord, which is only a little further in, where t = 3°, 2 and s = 34 ‰, not a single specimen was to be seen in all the dredgings made. *Bathyplotes* occurs in rather large numbers at its northern limit; at the station at the mouth of the Folden Fiord at a depth of 530 m., 20 individuals of this species were taken, but only 4 *Mesothuria*. Of clay-bottom molluscs, which have not hitherto been found north of Lofoten, the following may be mentioned: —

Malletia obtusa, Kelliella milliaris, Dentalium agile, Scaphander lignarius etc. The deepwater fauna on the mud-bottom is remarkably uniform in the large fiords which are filled with ocean water, from the Bokn Fiord to the Vest Fiord, nothwithstanding that the Vest Fiord and its adjacent fiords contain some forms which are wanting in the Bokn Fiord. Further investigations will probably equalize this apparent difference to some extent, for instance, I have latterly found *Rhizocrinus lofotensis* also in the Bokn Fiord. But it will probably be found that such a species as *Ulocyathus arcticus* cannot be included among the fauna of the Bokn Fiord, this species must, judging from what is up to the present known with regard to its distribution, be considered to be an arctic species, which has been able to exist under the natural conditions determined by the ocean water which penetrates into the fiords. On the whole, one may say that, zoogeographically speaking, the deep water fauna on the clay-bottom of the fiords in question are specially remarkable on account of the large number of forms in them which have a wide distribution southwards. But, north of Lofoten, the fauna on the clay have quite another character. The southern forms disappear, and the northern ones take their place. At my stations in the Lyngen Fiord (Lyngen II and III) at the respective depths of 250 and 320 m. on clay-bottom such forms as the following occurred in large quantities: — *Ctenodiscus crispatus, Myriotrochus rinki, Pecten groenlandicus* and *Astarte crenata*. Here too were found *Siphonodentalium vitreum, Scalaria groenlandica, Bela exarata* etc. The peculiar arctic Bryozo, *Alcyonidium disciforme*, was also taken here. *Diastylis goodsiri, Pseudomma truncatum* and many other arctic forms also occurred. At the station Lyngen II, d = 250 m., t = 2°,85 C., s = 34,47 ‰, and at Lyngen III, d = 320 m., t = 3°,65 C. and s = 34,84 ‰. At both stations in the Lyngen Fiord, several specimens of two actinia species were taken, but none were conserved. If I remember rightly, they were *Actinostola callosa* and *Bolocera tuediae*.

Edwardsia andresi and *Epizoanthus erdmanni* were also found. As I have previously mentioned, there is another character over the fauna in the deep waters of the Malangen Fiord, and if we go as far as to Lyngen and Kvænangen, the difference is even more striking. In the deep waters of Kvænangen where d = 343 m., t = 2°,3 C., and s = 34,49 ‰, were found, for instance, *Myriotrochus rinki, Polychæta*, e. g. *Harmothoë rarispina, Nephthys malmgreni, N. ciliata, Nicomache lumbricalis, Terebellides strömi.*

Mollusca: — *Pecten groenlandicus, Arca pectunculoides*, var. *septentrionalis, Astarte crenata, Siphonodentalium vitreum* etc.

[1] The *Holothurioidea* of Northern Norway. Berg. Mus. Aarb. 1902, No. 9.

Amphipoda: — *Haliragcs fulvocinctus, Idunella æquicornis.* The latter has, hitherto, only been taken in the Varanger Fiord.

Notwithstanding that the clay depths both north and south of Lofoten have some forms in common, the Vest Fiord, however, forms a very decided limit for fauna, as has been explained in the foregoing pages. One may also in the fauna of the Norwegian deep waters make a distinction between an arctic and a subarctic (boreal) clay-facies.

Remarks on the fauna of the ocean banks.

I was not able to make many dredgings on the ocean banks in 1899, but I succeeded. however, in getting an idea of their fauna. The station, Røst II, is not far from the ocean banks, at a depth of 150 mtrs. here *Capulus hungaricus*, which is a southern form, was dredged, here this form has its northern limit on our coast. On the banks themselves, it extends, perhaps, a little farther northwards. And at the station at Gaukværø, 250 m., t = 7°,1 C., s = 34,38 ‰, *Harmothoë oculinarum* was taken, this form must be characterized as a boreal one, judging from the places where it has hitherto been found. In the sea off Ingø (71° 10′ N., 23° 10′ E.), d = 315 m., t = 3°,45 C., s = 35,24 ‰, an amphipod, *Erichtonius abditus*, occurred, among other things; this form, according to G. O. Sars has a distribution as far south as The Azores, and was previously only known from „the south and west coasts of Norway". Taking into consideration the hydrographical conditions on the banks outside Lofoten, Vesteraalen, Tromsø and Finmark, one would expect to find that at any rate some boreal forms would be able to exist there. To get light on this subject, reference can be made to the material collected by the Norwegian North Atlantic Expedition. First I will give a table showing the temperatures at some of the stations in the southern bankdistrict of the Norwegian Sea (Stadt—Shetland—Lofoten). Cf. map of the district of the Norwegian North Atlantic Expedition.

Bottom temperatures on the southern banks in the Norwegian Sea.

Station Nr.	Situation.	Depth.	Temp.	Bottom.
9.	61° 30′ N. 3° 37′ E.	377 m.	5°,9 C	Clay.
10.	61° 41′ N. 3° 19′ E.	402 m.	6,0	Ooze, Clay.
92.	64° 0′ N. 6° 42′ E.	326 m.	7,2	Sabulous Clay.
79.	64° 48′ N. 6° 32′ E.	283 m.	6,9	Sabulous Clay.
101.	65° 36′ N. 8° 32′ E.	408 m.	6,0	Sabulous Clay.
147.	66° 49′ N. 12° 8′ E.	260 m.	6,2	Grey Clay

On these banks, one would expect to find an animal life which differs only slightly from that of the Norwegian fiords (The Bokn Fiord — the Vest Fiord), where there are corresponding temperatures. The investigations hitherto made appear to confirm this expectation. I will now give a table showing the bottom temperatures on the northern banks from Lofoten to Beeren Island.

Bottom temperatures on the northern banks in the Norwegian Sea.

Station Nr.	Situation.	Depth.	Temp.	Bottom.
195.	70° 55′ N. 18° 38′ E.	196 m.	5°,1 C.	Stones, Clay.
290.	72° 27′ N. 20° 51′ E.	349 m.	3,5	Sabulous Clay.
323.	72° 53′ N. 21° 51′ E.	408 m.	1,5	Clay.
280.	74° 10′ N. 18° 51′ E.	64 m.	1,1	Stones.
315.	74° 53′ N. 15° 55′ E.	329 m.	2,5	Clay, Sand.
326.	75° 31′ N. 17° 50′ E.	225 m.	1,6	Clay.

According to Friele and Grieg, 43 species of Mollusca were taken at station 195, several of which are widely distributed southwards. Among these may be mentioned: —

Cadulus subfusiformis, Cyclostrema petterseni, Capulus hungaricus (shells), *Alvania cimicoides, A. jeffreysi, A. subsoluta, A. punctura, Aclis walleri, Parthenia spiralis, Odostomia unidentata, O. acuta, Eulimella scillæ, E. ventricosa, Eulima bilineata, Adeorbis fragilis, Metzgeria alba, Buccinum humphreysianum* (shell), *Sipho fusiformis.*

At the stations previously mentioned in the northern bank district, forms also occurred which have a wide southern distribution. At station 315 (74° 53′ N.) a boreal Bryozo, *Bicellaria alderi*[1]) was taken. I have not on any other occasion noticed this species north of Lofoten. Undoubtedly there are several species which on the banks go further north than in the fiords, so that it is important to state clearly, when mentioning distribution, whether the species in question occurs in the fiords and the belt of skerries (skjærgaard) or on the banks.

Zoologically speaking, there remains much to be done with respect to the Norwegian ocean-banks, and a thorough investigation of the edge towards the deep basin of the Norwegian Sea would be highly interesting. For here the transition from boreal to arctic fauna occurs, and that too not spread over several geographical degrees of latitude, but in the space of a few hundred meters.

Shallow-water shells found at great depths.

Of late years, there has been a good deal of discussion among Danish and Norwegian authors as to the cause of the occurrence of littoral shells at great depths, especially in the Norwegian Sea. I do not intend to go into the matter, as I do not possess the necessary material to take part in the discussion of it. I would refer those who wish to have a clear account of the various opinions advanced to Dr. A. C. Johansen's[2]) paper, in which references will also be found to other works dealing with the same subject.

[1]) Cf. Nordgaard, *Polyzoa* of the Norw. N. Atl. Exp. p. 6, 26.

[2]) On the hypothesis on the sinking of sea-beds based on the occurrence of dead shallow-water shells at great depths in the sea. Medd. fra den naturh. Foren. i Kjøbenhavn 1902.

Those who have considered this question seem to have forgotten that also A. E. VERRILL has expressed an opinion with reference to transportation by ice.

In 1883, dredgings were made from S/S „Albatross" in the region of the Gulf Stream from off Cape Hatteras to Nova Scotia. In the „Results of the Explorations" (p. 507) VERRILL writes: — „In many instances we have also dredged pebbles and small, rounded bowlders of granite and other crystalline rocks from beneath the Gulf Stream in deep water. These, I suppose, have been carried to that region by shore-ice floating off in great quantities from our northern coasts in winter and spring, and melting where the warm Gulf Stream water is encountered." From this, it will be seen that VERRILL inclined to the opinion that the pebbles found in the deep water were brought thither by floating ice, and if the ice takes along pebbles, there is nothing to hinder for its also taking along shells from the coast.

In the Norwegian fiords, it is highly probable that drift-ice causes a transportation of littoral shells out into the deep basins. For instance, *Littorina rudis* and *obtussata* found at a depth of 150—180 m. on Risværflaket, and *Gibbula cineraria* at a depth of 600 meters in the Øxsund, (in each case the shells were empty) were neither of them in their primary locality. HANS KIÆR,[1]) too, has given a very plausible explanation of the storing of gravel and shells in the snow and ice on the shore, and their conveyance to places farther off when the ice melts in the spring; his explanation is based upon personal observations at Tromsø.

Fauna and Hydrography.

In the foregoing pages, I have tried to prove that there is a close connection between fauna and hydrography. It would from this again appear, that a majority of species of animals have an organisation which can only bear a very slight variation in hydrographical conditions. The number of socalled cosmopolitan species is very small, and it seems to me that the number of those which are mentioned as being widely distributed is also on the decrease. The more exact morphological investigation which is demanded nowa-days often results in the dividing of a species into two or more.

And this is the case, not only with bottom forms, but also with reference to plankton.

I will give some instances of what I mean. We have for years heard that *Calanus finmarchicus* is found in nearly every sea. But G. O. SARS[2]) now tells us that under the name *C. finmarchicus* was hidden another species, *C. helgolandicus*, CLAUS, which is specially distributed southwards, while the former has an arctic and boreal distribution. Strictly speaking, *Calanus finmarchicus* contained three different species, for *Calanus hyperboreus* was considered to be a variety of *C. finmarchicus* previous to the publication of Dr. GIESBRECHT's well-known monograph on Copepods. Instead, therefore, of one species distributed over nearly every sea, we now get three species with comparatively limited distribution, *C. hyperboreus* being arctic, *C. finmarchicus* boreal and arctic and *C. helgolandicus* lusitanic.

Similarly with respect to *Euchæta*. Instead of the widely distributed *Euchæta norvegica*, we now have, *norvegica, glacialis* and *barbata*. Examples might easily be multiplied from the Copepods. On the other hand, it is beyond doubt that there are also deep-water forms of Copepods which have an exceedingly wide distribution. Natural conditions are only subject to very slight changes at the great depths, and this too for extensive stretches. It is also very probable that there are shallow-water forms which are so organized as to be able easily to adapt themselves to changes in natural conditions, and are thus able to exist under very diverse physical conditions, but their number has undoubtedly been over rated. In his excellent monograph on northern *Annulata*, G. M. R. LEVINSEN[1]) says: —

„I must say that I doubt whether the northern seas really have so many species in common with the Mediterranean as would appear from the lists given in the literature available." On account of this doubt, LEVINSEN carefully compared the northern forms and those from the Mediterranean, and come to the conclusion that *Arenicola marina* and *Pectinaria koreni* from the latter sea were different from the northern species bearing the same name. They were given the names *A. claparèdi* and *P. robusta*.

Similarly with respect to *Pectinaria auricoma*, *Potamilla reniformis* etc.

I could give a number of examples from the Bryozoa too, to show how the extent of the distribution of a species diminishes, as the claim for greater exactness in the determination of a species increases. The change which has taken place in the use of the word „species" with regard to the Bryozoa, has had a similar effect. F. A. SMITT, for instance in his work on boreal and arctic Bryozoa, which in other respects is excellent, has used the word „species" in a very extended sense. He has entered as „forms" a large number of specimens which are given the rank of „species" by recent systematical investigators.

As a result, SMITT's species were attributed with a much too extensive geographical distribution.

The distribution of a species is undoubtedly dependent on many other things than the temperature and salinity of the water in which it exists. Currents especially have both a direct and indirect influence. If one considers the conditions on the Norwegian coast, where arctic and boreal fauna meet, the question naturally suggests itself: — Is it the arctic or the boreal animals which on our coasts are gaining ground?

To settle whether the movements of a given element of fauna or flora are progressive or retrograde, one can examine the currents in the adjoining sea. On the Norwegian coast, the current which flows in a northerly direction is predominant, and the southern animal forms are carried along with it. On the east coast of North America, the reverse is the case. The duration of the pelagic state is also important with regard to the penetration of the species into new districts. It would therefore seem likely that such species as *Mytilus edulis* and *Modiola modiolus*, in which the pelagic state hardly lasts much more than a week, would find it difficult to get over the space between two coasts which are separated by a wide expanse of ocean. Along a length of coast line, however, these and similar species are widely distributed, for, in the course of thousands of years, the many small steps forward amount to a considerable distance.

I do not know very much about the plankton in the more southerly seas, but I have the impression that there is not so much difference there in its quantity and quality at the different times

[1]) Niveauforandring eller transport. Naturen, 1902, p. 364.

[2]) Crustacea of Norway, Vol. IV.

[1]) Systematisk geografisk Oversigt over de nordiske *Annulata, Gephyrea, Chætognathi* og *Balonoglossi*. Aftryk af Videnskab. Medd. fra den naturhist. Foren. i Kjøbenhavn 1882 og 1883 (p. 287).

of year, as is the case in the northern latitudes.[1]) And if this be a fact, its influence will be seen on the plankton-eating animal world. It is possible that the suitability of the molluscs as zoographical character-forms, depends upon the fact that a great many of them are plankton eaters. The mud-eating worms, for instance, are much less suitable in giving a characteristic of the fauna. Besides, there are species of mudeaters with a small geographical distribution. A star-fish, *Ctenodiscus crispatus*, whose stomach is almost always full of mud, is very little found beyond the arctic district. In such cases, one is compelled to conclude that the animal has very little power of adaptation.

Further Remarks on Plankton.

In the fiords near Bergen, February is the month in which the plankton is poorest, and there is reason to think that the minimum for the year, for the northern fiords of Norway, also falls in this month. The great change in plankton life occurs at the spring inflow of the diatoms.

In the fiords near Bergen, March is the month when the diatoms begin to show themselves en masse, but at different times, within the limit of this month, from year to year. It is not yet possible definitely to fix the time when the winter state gives way to the spring one in the northern fiords, but it is probable that the spring-diatoms appear in very large quantities somewhat later here than in the south west fiords. Below I give some data concerning the occurrence of diatoms on the northern coasts.

In the Tys Fiord on $^{29}/_3$ 1899 only a few diatoms were found, but on $^1/_4$ they were numerous near Lille Molla, and this was also the case on $^4/_4$ in the same year at Høla near Svolvær.

$^{10}/_4$ 1899. In the harbour at Stene in Bø (Vesteraalen) many diatoms, 0—3 m.

$^{12}/_4$ 1899. The Malangen Fiord, many diatoms. Whilst there in Malangen, from 12th—14th of April 1899, was a rich development of diatoms, in Kvænangen on 19th of the same month, winter conditions prevailed. But on $^{21}/_4$ the spring diatoms also had shown themselves in Kvænangen.

$^{23}/_4$ 1899, Trold Fiord harbour, many diatoms.
$^{24}/_4$ 1899, Ingøhavet, many diatoms.
$^{26}/_4$ 1899, Repvaag harbour, diatoms.
$^{27}/_4$ 1899, The Porsanger Fiord, many diatoms.
$^{28}/_4$ 1899, Mehavn, diatoms.
$^1/_5$ 1899, Vardø, some chains of diatoms.
$^5/_5$ 1899, Høla near Svolvær, few diatoms.

At the place last mentioned (in Lofoten) the first rush of diatoms was over. In place of them, there were multitudes of forms in different stages of development belonging to *Copepoda, Cirripedia, Annelida* etc.

$^{22}/_3$ 1900, The Østnes Fiord, 0—25 m., development of the spring diatoms.
$^{30}/_3$ 1900, The Vest Fiord, 0—25 m., many diatoms.
$^2/_4$ 1900, The Skjerstad Fiord, still winter conditions.
$^5/_4$ 1900, The Salten Fiord, many diatoms.
$^6/_4$ 1900, The Folden Fiord, still winter conditions.

Previously in this treatise, it has been shown that the Vest Fiord is the most important terminus for a great number of southern bottom forms. It is probably also the case, if one substitutes plankton forms for bottom animals. North of the Vest Fiord such species as *Pleuromamma robusta*, DAHL, and *Candacia armata*, BOECK, will hardly be found. In the Norwegian series of fiords, *Euchæta norvegica*, for instance, is not found north of the Vest Fiord, but I took specimens of *Chiridius armatus* in Malangen.

The very large quantities of such *Siphonophora* as *Cupulita sarsi* and *Physophora borealis* along the northern coast and in the northern fiords during the winter of 1899, was an occurrence which merits further mention. Of the forms mentioned, *Cupulita sarsi* was exceedingly common. On $^{20}/_4$ I saw in the Jøkel Fiord (arm of Kvænangen) a fisherman whose gloves on the inside were striped red by the remains of this siphonophor which had fastened itself to the fishing lines. The inhabitants looked upon this as being something unusual, which points to the fact that the phenomenon is not of annual occurrence. As the plankton species in question are oceanic, their occurrence in large quantities in the fiords can hardly be explained in any other way than by supposing that there had that year been an unusually strong flow of the current in the upper layers of water in the sea towards the coast and into the fiords. It occured to me to connect this with the prevailing winds. To be able to form an opinion of the relation between the sea and land winds, we will look at the downfall for the period in question.[1])

Downfall from October 1898—March 1899.

	Bodø		Tromsø		Gjesvær		Vadsø	
	Downf.	Normal	Downf.	Normal	Downf.	Normal	Downf.	Normal
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1898.								
October.....	108	106	86	98	77	79	53	80
November...	148	109	184	86	113	66	61	69
December...	153	87	75	103	100	68	121	60
1899.								
January.....	70	77	58	108	78	55	79	50
February....	129	61	174	110	78	57	55	45
March......	96	61	80	95	69	61	114	41
Average	117.3	83.5	109.5	100	85.8	63.5	80.5	57.5

As it is more especially the ocean winds which cause downfall, one must be justified in concluding that, from October 1898 to March 1899, their influence on the coast line in question must have been greater than usual. But this would again result in more than the ordinary quantity of water being driven in from the sea coast, which must be evident in the kind of plankton which occurs.

In this connection, it is also interesting to recall that, on the south west coast of Norway (in the spring-herring district), the fishermen call some *Salphæ* „silderæk",[2]) and they look upon their appearance as a sure sign that the herrings will come in shoals to the coast. It is not altogether impossible that scientific investigations will verify this prognostication. At any rate, it appears to be quite reasonable, that the prevailing ocean winds stir up surface currents which drive both herrings and their food towards the coasts.

[1]) Both large and small animals, from the Spitzbergen-reindeer to the plankton-crustaceans, find that winter in the arctic zone is a time when food is scarce.

[1]) Cf. Nedbøriagttagelser i Norge. Aarg. IV (1898) og V (1899).

[2]) From sild (herring) and reka (to drift with the stream).
Cf. M. SARS, Fauna littoralis Norvegiae, Part I, p. 68.

B. The Investigations considered from a practical Point of View.

The Vest Fiord is one of the most thoroughly investigated of our fiords, speaking in a biological and hydrographical sense. And the reason for this is not difficult to understand. The government has found it necessary to send naturalists to the district in which a cod fishery is carried on, upon the results of which the income of the country shows an important rise or fall, in proportion to the success or failure of the catch. The statistics taken have shown that the catch varies quite considerably from one season to another, and it has been the aim of the investigating naturalists to discover the factors which have an influence on the fate of the fishing. The most important marine animals for us are undeniably cod and herrings, but in addition to these, there are many other fish which are caught in large quantities on the coasts of the counties of Nordland, Tromsø and Finmark.[1] I will first mention some invertebrates, which are of economic importance. Then I will deal with the cod fisheries in Lofoten and Finmark.

a. Some Invertebrates of economic Importance.

The animals may be divided into the following groups: — injurious, indifferent, indirectly useful, directly useful, if account only be taken of their useful or baneful relation to mankind.

A decidedly injurious animal is *Myxine glutinosa,* which sucks out the fish caught in nets and on lines. Such forms as *Calanus finmarchicus, Boreophausia inermis, Nyctiphanes norvegica,* many worms, molluscs etc., may be said to be indirectly useful, as they serve as food for edible fish.

To the directly useful animals, belong first of all those which are eaten by man, then those from which useful products are obtained, and lastly those which are used as bait for the edible fish. Only some of those which are directly useful to man shall be mentioned here.

Arenicola marina, Lin.

This polychæt occurs rather numerously and at many places in muddy beaches, it is dug up by the fishermen and used by them as bait. Similarly too, a fish *(Ammodytes tobianus)* is taken and also serves as bait.

Pecten islandicus, Müll.

The Trondhjem Fiord is the most southerly place, on our coast, where this mussel occurs of sufficient size and in such quantities as to give it any economic importance. According to V. Storm, it is particularly plentiful on the banks north of Tautra, where it has been dredged for a very long time and has been used as bait. Of late years it has also been taken to Trondhjem and used as food. In the north of Norway, too, this species is a much prized bait, and S. Schneider says that it is eaten by many better-class families at Tromsø. The southern limit on our coast for the occurrence of this species, is the Lyse Fiord, not far from Stavanger (59° 8′ N.).

Mytilus edulis, Lin.

On our northern coasts, this species is as a rule so small that it is not of much use as bait.

Modiola modiolus, Lin.

At the present time, this is our most important bait-mussel, it is found in large quantities at some places on our northern coasts. It is used as bait on the day fishing lines in Lofoten. The greatest part of the shell-bait which is used in Lofoten is, however, taken from the fiords in the neighbourhood of Bergen and Stavanger. This mussel attains to a considerable size in the western fiords. A specimen from Lonevaag (Osterø) was, for instance, 17.3 cm. long and 9.5 cm. wide. The shells held about $^1/_2$ liter.

I have measured unusually large specimens from the Sogne Fiord, from 17 to 18.4 cm. In the Oster Fiord, where shells to the value of several thousand kroner have been dredged, I took 100 from a heap at Raknes. The most usual measurement of the shells which were sorted out here to be used as articles of commerce, was 10—15 cm. In the arctic district of our country, *M. modiolus* does not attain the size of those in the western fiords. A specimen from Vardø was, however, found to be 11.2 cm. long and 5.3 cm. wide.

It is quite usual to find the tubes of *Pomatoceros triqueter* and various forms of Bryozoa and Hydroida on the shells. On one single occasion, I saw in an aquarium *Cancer pagurus* crush these shells to eat them.

In the aquariums of the Bergen Biological Station, we have had *M. modiolus* for many years, and their mortality has been low. Spawning in these aquariums has been observed on $^{20}/_8$ 1899, $^2/_8$

[1]) Cf. Helland, Lofoten og Vesteraalen, p. 119.

1901 and $^{12}/_{7}$ 1901. From what I have been told by those engaged in dredging shells, I conclude that spawning also takes place in the months of March and April. Spawning time may therefore be supposed to be from March to August. The spawning process itself was seen quite plainly on $^{2}/_{5}$ 1901. Both eggs and sperm emerged through the anal sipho. The eggs were ejected in the form of narrow, short ribbons which were, for the most part, broken up in the water and immediately sank to the bottom. A single female shell expelled so many that a large reddish-yellow elevation was formed. Some of the eggs were whirled about in the water and were greedily devoured by shrimps and barnacles; some settled down in empty mussel shells and in the openings of the lumps of *Pomatocerus triqueter,* which covered the living and dead specimens of *M. modiolus.* On closer investigation, it was found that only a small number were fecundated. This was especially so with regard to the reddish-yellow mass above mentioned, these eggs soon began to decompose.

I also succeeded in seeing fecundated eggs at several stages of development. The eggs, which were 0.078—0.09 mm. in diameter, had no special colour. Division was, as in other mussels, complete and inequal. There is reason to suppose that fecundation took place outside the female's body.

While spawning goes on, the eggs (and the sperm) are pressed out through the genital openings, one on either side, then the spawn passes through the innermost branchial passage, close up to the hindermost constrictor and finally enters the cloacal room to be expelled thence into the water through the anal sipho. The reason for the eggs assuming the form of narrow, short ribbons is probably that the genital opening is a column and not a pore. The eggs rushed quite quickly out of the anal sipho, and it is most probable that fecundation did not take place until they were protruded here.

On $^{12}/_{7}$ 1901, spawning of specimens which had been in the aquarium about a year, was observed. Sperm was so plentiful as to give the tank the appearance of being filled with milk and water. There was at the same time a strong stream of water flowing into the tank and this caused the eggs, for the most part, to whirl about in the water. But as soon as the stream of inflowing water was turned off, the eggs sank to the bottom. The process of division took place rapidly. Already in the evening of the same day ($^{12}/_{7}$) the eggs were divided into a large number of small balls, and the next morning at 9 o'clock ($^{13}/_{7}$) they had become larvae, which were wheeling around by the help of cilia and describing tiny circles. They had formed themselves into irregular small lumps, which moved about at the bottom, their movements being quite regular. Three days later ($^{15}/_{7}$) the specimens were seen to have larval shells and velum. These shells were 0.1 mm. long, their ventral side being curved and the dorsal forming a straight line. The velum could be drawn entirely inside the shells. At this stage, the young *Modiola* possess a considerable power of motion, for they swim quickly about by means of their velum. Instead of being confined to a rotatory motion with very little change of centre, they now moved more in a straight line. When they were six days old, the specimens at the „velum" stage were seen to have acquired circle shaped shells, the straight edge which represented the dorsal side having become more curved. The length of the shells was 0.156 mm., width 0.130 mm. The development of these particular specimens was not followed further, but, from analogy with other mussels, we know that the next important stage is the disappearance or alterations of the velum, while the foot now performs the motion, until the little animal finally attaches itself to some object or other. To catch these animals, a shell dredge of a special construction is used, and also a „stikkert", which is a kind of pinchers with three or four claws.

Sometimes too they are taken by divers. They are taken out of their shells after being brought to land. In addition to the shells, the bundles of byssus and the gills are also removed. The remainder is salted in kegs containing 28 liters. If the shells are large, about 400 are enough to fill a keg, but as a rule from 700—800 are necessary. The price is about 9 kroner (10/—) per. keg at first hand, and as the expense of catching them is very slight, mussel fishing may be very profitable.

I have referred somewhat at length to *Modiola modiolus,* as this particular mussel plays an important part as bait in the cod fisheries at Lofoten.

Cyprina islandica, Lin.

This animal is used as bait in ordinary fishing, but sometimes too in fishing ocean cod.

As for instance in 1896, about the middle of March, at Balstad fishing station, where it was asserted that there were good results when using this bait.

Besides *Cyprina,* which was dredged somewhere in Napstrømmen, *Arenicola marina* was also used, which was found near the Balstad station.

Zirphæa crispata, Lin.

This peculiar mussel was noticed by me in 1899, alive, in the sand on the beach at the farm Sund, in Gildeskaal; several specimens were dug out and used as bait.

Ommatostrephes todarus, Raf.

„Sprut" and „akker" are common names in the north of Norway for this Cephalopod species, which, in the autumn come in to the coast in large quantities and thence into the fiords, where they are taken in thousands to be used as bait during the cod fishing in Lofoten. In the Kvæ Fiord in the north of Hinnø a considerable catch of cuttle-fish has of late years been made. In many instances, a single family has made an income of kr. 600—800 in the course of a few weeks.

Pandalus borealis, Krøyer.

During the investigations in the Skjerstad Fiord in April 1900, several specimens of this species were met with, and 1903, Niels Haagensen, who was my assistant at the earlier date, made some trial catches with a shrimp trawl, and he succeeded in taking from 10—30 liters each time. So that it was thus proved that *P. borealis* occurs in large quantities in this fiord.

This species is now sent to Bergen and Kristiania to be used as food in no small quantities, but in the north of Norway it is more difficult to sell them, so that there is not much prospect of making much profit on them.

Haagensen, has, nevertheless, suggested that a trial should be made to salt them, prepared as bait, for the fisheries in the north. His suggestion might, at any rate, be found useful for such times as there is a scanty supply of other bait.

H. Kiær at Tromsø in 1903 made investigations with respect to the occurrence of *P. borealis* in the Bals Fiord, the Tromsø-sund, the Kvalsund and the Kal Fiord.

In the inner part of the Bals Fiord, he fished, on an average, 3 liters pr. hour with a little shrimp trawl, but at the other places mentioned, *P. borealis* only occurred singly.[1]) The author mentioned is not sure that it would pay to carry on this kind of fishing, even in the Bals Fiord, under present conditions. The day will, however, doubtless come when it will be found profitable to do so, also in the northern districts where this species is found.

Cancer pagurus, Lin.

The species is of no importance in the economy of the northern districts, as it occurs very sparsely. Concerning its distribution, it should be noticed that M. Sars[2]) mentions having found it at Lofoten. Sparre Schneider has informed me that it does not go so far north as Tromsø. Schneider has also told me that the common crab, *Carcinus maenas,* has its northern limit at Dyrø and the outer coast of Senjen. For the present, Lofoten ought, therefore, to be considered to be the northern limit for *C. pagurus.*

Homarus gammarus, Lin.

M. Sars says (l. c. p. 124) that lobster is only rarely found in Lofoten and the Folden Fiord ($67\frac{1}{2}^{\circ}$ N.).

Later on, it was proved that lobster is found in the Tys Fiord. In 1896 „Nordlands fiskeriforening", on the suggestion of inspector Dahl, decided to use a sum of money on trial fishery. About one hundred lobsters, large and of a good flavour, were caught, but no actual lobster fishery has resulted from this trial. It would indeed be quite unique, if an animal should be found in such large quantities near the boundary limits for its distribution as to make it possible to carry on a profitable catch.

It is, of course, a necessary condition that, to be of any economical importance, a marine animal must occur in comparatively large numbers within a limited area. *Buccinum undatum,* for instance, would no doubt be excellent bait, but as it does not occur so close together as *Pecten islandicus* or *Cyprina islandica* it is of little practical importance.

A form, which has recently been taken into use, is *Nyctiphanes norvegica,* M. Sars. At one place in the Trondhjem Fiord (near Verdalsøren) a large number of this Schizopod is washed ashore, and in recent years they have been salted and used, with excellent results, as bait for haddock *(Gadus aeglefinus).*[1]) On our northern coasts, *Boreophausia inermis* occurs in large numbers, and it is probable that also this form, as well as *Nyctiphanes,* may be used as bait for haddock.

b. The „Skrei" Fishery in Lofoten.

The Lofoten fishery is very old. In the latter half of the 9th century Torolv Kveldulvsøn lived at Sandnes in Alstenø, and it is said of him, in Egil's historical tales, that he had sent men out fishing „skrei" at Vaagan (Lofoten) and some were also gone to fish herrings.[3]) In the same tale too, it is related that Torolv sent his trusty man Torgils gjallande to England with a vessel laden with dried „skrei", furs, etc. And wheat, honey, wine and clothes made up the return cargo from England. There are many historical references, in the following centuries, to the fisheries in Lofoten, but I will only here refer to some of them.

The tackle used in the old times took the form of hand-lines, about A. D. 1600 longlines came into use, and about the year 1700 nets appeared upon the scene. At the present day all three are used.

For several centuries the „skrei" was exclusively prepared as „dried fish", the head was cut off and entrails taken out and then the fish was hung up to dry. Towards the end of the 16th century some trials were made to prepare „klip" fish (tør-fisk = dried fish = stockfish [commercial], klipfisk = salted, dried cod).

In a description of Lofoten in 1591,[4]) we read that the fish was first salted and then dried on the rocks so that it became „as hard as a piece of wood". In the same account, it is also mentioned that in the summer when the fish were dried and the oil was pressed out of their livers, traders came to Lofoten to barter barley, rye, salt, iron, clothes, linen etc. in exchange for the fish and cod liver oil. The primitive preparation of the latter consisted in the collecting of the liver in large cisterns, which were exposed to the direct heat of the sun, the oil was thus melted out and drawn off little by little. About the middle of the 17th century, cod-roe began to be considered as an article of commerce.

Preben von Ahnen, the last of the feudal lords of Nordland, made strenuous efforts to effect the sale of cod-roe, and in 1658 he obtained a license from Fredrik III to trade in this article.[2])

About the year 1600, Peder Claussøn Friis relates that it was forbidden, under severe penalty, to throw single cod heads into the sea, for fear that fish should eat them to their harm. If one, at that time, wished to be quit the heads of cod one had to string them together and sink them. However, the same writer mentions, some heads were dried to be used as fodder. Now-a-days, the heads and back bones, which are removed when cod is prepared as „klip"fish, are made into guano in factories erected for the purpose. So that not only the flesh of the cod, but also its head, backbone, liver and roe are now made use of. The sperm bags are also sometimes used as fodder, but the rest of the entrails are still thrown into the sea.

The honour of founding the present cod-liver oil industry belongs to a Norwegian pharmaceutical chemist, Peter Møller, he having started the first factory for the preparation of medicinal cod liver oil in 1853.

His son, Dr. F. P. Møller studied the subject also, and he has, in a comprehensive work,[3]) explained the scientific basis of the method adopted by his father.

[1]) Cf. H. Kiær, Om forekomsten af dybvandsræker ved Tromsø. Norsk Fiskeritidende, 1903, p. 624.

[2]) Kristiania Vid. Selsk. Forh. 1858, p. 123.

[3]) Cf. Egils saga Skallagrimsonar. Reykjavik, 1892, p. 39. „Han havði þá menn i skreidfiski i Vágum, enn suma i sildfiski."

[4]) Beskrivelse over Lofoten o. s. v. Det kgl. norske Vid. Selsk. Skr. i det 19de aarh., B. 1, p. 473.

[1]) Cf. Nordgaard, Et nyt agn for hysen. Norsk Fiskeritidende, 1903, p. 618.

[2]) Cf. O. Nicolaissen, Fra Nordlands fortid. Kristiania, 1889, p. 80.

[3]) Cod-Liver Oil and Chemistry, London, 1895.

From 1859, there are statistical reports of the Lofot fisheries, including remarks on the course of the fishery etc. There is probably no instance of a completely unsuccessful fishing season, it has, however, happened that only very little has been caught and the quality has not always been equally good. The exact statistics show that the variations in quantity have been very considerable. As the prosperity of thousands depends upon the fishing, the inhabitants have tried, in the course of the centuries, to discover different signs upon which to build prognostications, and resource was even had to divination. For instance, AXEL HAGEMANN[1]) relates that the fishermen, in Saltdalen, made use of the following device, to be able to foretell the prospects for the Lofot fishing season. On Christmas Eve an outline of the Lofot islands was made on a deep dish, which was then filled with water and put aside to freeze during the night. If there were, the next morning, found to be a good number of air-bubbles formed in the dish, it was said that the coming fishing-season would be a good one. And according to the position of the bubbles, one tried to decide at which places there would be most fish. According to Prof. H. STRØM,[2]) the fisherfolk in Søndmør adopted a similar method to discover what the cod-fishery, which began directly after Christmas, would be like.

As time went on, scientists began to concern themselves with problems connected with the fisheries. The wonderful progress made in natural history, which is due to CARL LINNÉ, was also seen in an increased interest in the study of the natural causes which are the necessary conditions for the carrying on of various industries. MARTIN VAHL was a Norwegian who had studied under LINNÉS guidance, and he in his turn had a pupil, JENS RATHKE, who was sent, in 1801, to Northern Norway on account of the fishing which was being carried on there. RATHKE's report of this journey has not been printed, as far as I know, but various extracts from it may be found in a topographical-statistical work by A. HELLAND on the county (amt) of Tromsø. It is G. O. SARS who, in our country, actually laid the foundation for fishery investigations, in the years 1864—70, when he made his wellknown investigations in Lofoten. In 1874, he also visited Finmark to examine into certain questions concerning cod fisheries. The Norwegian North Atlantic Expedition 1876—78, also had matters of a practical scientific nature with regard to the fisheries on its programme. From this period, there are a series of valuable „reports" written by SARS, in which a great many fishery phenomena are discussed.

I have previously given an account of the hydrographical investigations which have been made in the Lofotfishery district.[3]) In the years 1900—01, Dr. HJORT, on S/S „Michael Sars" made extensive investigations along the northern coast of Norway. In his preliminary account, Dr. HJORT gives many important results, among which may be mentioned the exceedingly interesting fact that the young of the cod is found far out in the Norwegian Sea in the summer, while spawning chiefly takes place on the coast banks, and in a less degree in the fiords. HJORT has given a very instructive chart (l. c. p. 43) showing the distribution of the eggs and young of the „skrei" in the summer of 1900 and 1901. From this it would appear that the movement from land is not the same every year.[4])

[1]) Blandt lapper og bumænd, p. 101. Kristiania, 1889.

[2]) Søndmørs beskrivelse, I, p. 536. Sorøe, 1762.

[3]) Cf. NORDGAARD, Contribution to the Study of Hydrography and Biology on the Coast of Norway, p. 5—7. Bergen, 1899.

[4]) HJORT, Fiskeri og hvalfangst i det nordlige Norge. Bergen, 1902.

During the last twenty years, when the Lofot-fishery season has not been a good one, the usual explanation for this fact has been offered in the circumstance that the temperature of the water has been too low. In the course of time, however, so many measurements of temperature have been made that it must be possible to form a decided opinion on the actual relation between the quantity of fish and the temperature of the water. I have previously dealt with this subject, and will now repeat that at the depths where fish is generally found the temperature is approximately the same year after year; consequently the thermometer cannot, as a rule, be taken as a guide. Capt. GADE, too, arrived at a similar conclusion, as a result of measurements of temperature made in the Lofoten fishing waters in the years 1891—92.[1]) On a former occasion, I mentioned, among other things, that the fluctuations in the quantity of fish might possibly be accounted for by the variations in the number of sexually fully developed „skrei". I must, however, confess that a more careful consideration of the question makes this supposition much less likely. The investigations made by HJORT and DAHL in recent years have made it clear that quantities of cod are found in the summer on the Finmark banks and in the sea between Norway and Spitzbergen. Of these, the sexually fully-developed individuals in the winter go westwards and southwards to spawn, while the younger ones (loddetorsken) stay near the coast of Finmark. As there is every reason to suppose that, even in the most successful seasons, only a small fraction of the whole number of spawning cod is fished up, it must be concluded that quite extraordinary variations in their number would have to occur if there were to be any noticeable effect on the catch. The natural instinct, whether it be intense or slight in degree, which impels to a change of environment, must be taken to be the same year after year for the same species, and finally, the conclusion is reached that the fluctuations in the quantity of fish must depend upon certain conditions in the medium in which they move. The investigations made up to the present appear entirely to confirm the opinion that it is not the differences in temperature and salinity which determine the yield of fish. The properties of *Gadus callarias*, which determine this in Lofoten, must certainly be taken to be the same, year in and year out; on the other hand, such things as the number of fishermen, of days when it is possible to put out to sea etc. are subject to variation. But I am convinced that such variations alone are not a sufficient explanation of the fluctuations in the yield of fish. With respect to the number of fishermen, this decreases on account of the fall in the yield, while a prospect of better yield increases the number of fishers. There must, therefore, be conditions in the sea itself, which contribute in various degrees to increase, or diminish, the effect of the positively active factors, which, in spite of everything, have exerted so much influence as to prevent the Lofot fishery from having at any time been altogether a failure. By the yield of the Lofot fishery is meant, in the Norwegian fishery statistics, the „skrei" (ocean cod) which is caught from the middle of January to the end of April, during which period an official control is exercised, in the district from Guldviken to Lofotodden. During the decennium 1886—95, the average yield was 26.53 millions. The maximum was reached in 1895 with 38.6 millions. For the years 1896—1902, the average yield was 16 millions, the greatest catch was in 1897 (25.8 millions) and the least in 1900 (8.4 millions). The year 1895 forms the turning point, and it is tolerably natural to set the limit here. If

[1]) Temperaturmaalinger i Lofoten 1891—92. Kristiania, 1894.

comparison be made with statistics for 1859—85, it will be seen that the years 1886—95 were particularly favourable ones, while from 1896 up to the present time, there have been unusually bad seasons. In this clearly defined state of things, there lies an increased possibility of getting at the causes thereof, and I have tried, in various ways, to connect facts, but it was a long time before I succeeded in finding anything which seemed to point to a law. During my work, however, the opinion has gained upon me that the movements in the sea itself have a great effect upon the direction taken by the fish. A. Boeck, to whom much is due for his study of the spring-herring fishery, was of the opinion that the herrings went against the stream, but later observers do not agree with him in this matter, and I believe that both herrings and cod most probably, as a general rule, move with the stream. So that a very careful study of the currents in the sea is of great practical import. In recent years, V. Bjerknes, Sandstrøm and Helland-Hansen have developed the analytic apparatus to be used in calculating the movements of the sea, but it would seem that these scientists have taken no account of the wind. In his well known work on the Norwegian Sea, Mohn, has, on the contrary, very strongly emphasized the importance of the wind as a cause of currents, and this opinion is shared by many foreign hydrographers. With regard to the mutual dependence of winds and currents upon each other, it may, generally speaking, be said that a constant off-land wind causes a corresponding current from land, while during a constant sea-wind, the water is forced in towards the coasts. In the spring (March and April) the water on the west coast of Norway is particularly low, the supply of fresh water being slight, but more especially does the continual land-wind blow a quantity of water away from the coasts. At the end of March this year (1904), there was in Bergen continually easterly winds, which were so strong that they kept the tide waves so much at bay as to make the difference between ebb and flow very slight indeed. Similarly, a strong sea-wind in the late autumn is able to keep the water for days at an unusually high level. It is, however, clear, that, during the movements to or from the coast of the surface water, a compensating current must be set in motion in the deep water; it has long been a recognized phenomenon in the fiords, that the surface and under-currents go in contrary directions. If we now take it for granted that both herrings and cod are to a certain extent drawn along by the currents, it naturally follows that one must try to find out whether it be the motions in the surface-layers or the deeper situated compensation-currents which exert a special influence on the direction taken by the fish. Keeping this question to the fore, I have gone through a large number of fishery reports, and it seems from these to be fairly certain that the herrings move coastwards especially in the surface layers, while the „skrei“ travels along in the deeper layers. This would imply that herrings are most influenced by the surface-currents, cod by the compensation-currents. In reports on spring-herring fishery, it is, for instance, mentioned that small lots of herring (the so-called „Aater“) are often seen drifting along with the stream, and there are many remarks made by skippers about the sea being of a peculiar colour just beyond the spring fishery district, and that this is caused by the large number of herrings which are there present, and this fact denotes that the fish cannot be at any great depth. There is, however, no reason why the herrings should not lower themselves deeper in the water, but as a general rule, I think one may conclude that they move principally in the upper layers. On the other hand, no one has observed shoals of „skrei“ off the coast, and the first „skrei“ of the year is, in fact, usually taken from a depth of 100—150 meters. It must, therefore, be supposed that as cod and herrings, to a certain extent, depend upon contrary current phases, a particularly good spring-herring fishery would prevent a correspondingly good cod fishery in the same district; for a strong tendency of the upper layers towards the coast certainly takes herrings along in the current, but this at the same time causes a compensation current in the deep water, and this current hinders the cod in its passage to the spawning places. It is indeed specially mentioned in reports on spring-herring fishery, that, in really good herring years, cod does not, as a rule, occur in any quantity.

The „skrei“ fishery takes place in Lofoten in the months January—April.

Let us have a look at Mohn's Climate tables (Vol. IV), so as to get an idea of the winds prevalent at this time of year. We find that at Skomvær, from October—April, the prevailing wind is from S. At Andenes station, there is prevalent southerly wind from September—April, and at Fruholmen station from SE in the months of October—March. From this, it would follow that, as a rule, the wind and the surface current go in a contrary direction to that taken by the cod from the northern banks, while the under-currents probably go in the same course as that which the cod has to follow. On looking through the remarks on the weather which are found in the annual reports of the Lofot fishery, I have got the impression that the cold-bringing easterly winds by no means retard the fishing, as has been stated, but that they, on the contrary, assist it. For instance, the following paragraph is found in the chief controller's report on the excellent season 1895:—

„Easterly and north-easterly winds were prevalent, with clear skies and frost, north-westerly and westerly winds and snow were not unusual either, but southerly winds and rain were rare.“ When easterly winds prevail, it is found that the surface temperature on the Lofoten banks falls considerably, and the principal reason for this fact is that the wind sweeps along the cold surface water from the fiords, while the under-currents undoubtedly go in a contrary direction and carry along the cod.

As a result of the foregoing, it is quite natural to conclude that the fluctuations in the Lofot fishery really are due to the distribution of atmospheric pressure, or, in other words, the direction and strength of the winds. As, however, there are many difficulties to be surmounted in studying the changes in the influence of winds, I have chosen another thing, which is greatly affected by them, namely downpour. I take it for granted that the annual downpour must, taken generally, give a measure of the influence of the winds. By noting the changes in downpour from year to year, one must be able to form an opinion of the relation of the sea and land winds to each other; for upon this, according to the theory stated above, depends the success of the fisheries. In the „Observations of the Downpour in Norway“ published by the Norwegian meteorological institute, we have an excellent aid in studying the fluctuations in downpour. From this work, I have taken the necessary data to enable me to give the following table, which shows the annual average height of downpour in millimeters, at a series of coast stations, during the years 1886—95 and 1896—1902, as well as the calculated normal height.

Station	1886—95	1896—1902	Normal
	mm.	mm.	mm.
Fredrikshald	725	682	718
Kragerø	1027	925	1019
Tvedestrand	1181	1118	1157
Oxø	1073	810	1000
Mandal	1491	1348	1339
Skudenes	1181	1151	1158
Ullensvang	1375	1355	1297
Bergen	2096	2250	1916
Florø	2233	2348	2050
Aalesund	1234	1396	1170
Kristiansund	1148	1158	1097
Trondhjem	1013	1033	1001
Nordøerne	..	765	817
Brønnø	960	884	897
Sandnessjøen	1104	1008	1080
Bodø	923	1248	905
Svolvær	..	1301	1284
Tromsø	981	1120	1017
Gjesvær	665	729	669
Vardø	..	731	625

For the sake of clearness, I have, in the following table only put a + to represent those average values which are greater than the normal ones, and a — for those below the normal ones.

Station	1886—95	1896—1902
Fredrikshald	+	—
Kragerø	+	—
Tvedestrand	+	—
Oxø	+	—
Mandal	+	+
Skudenes	+	—
Ullensvang	+	+
Bergen	+	+
Florø	+	+
Aalesund	+	+
Kristiansund	+	+
Trondhjem	+	+
Nordøerne		—
Brønnø	+	—
Sandnessjøen	+	—
Bodø	+	+
Svolvær		+
Tromsø	—	+
Gjesvær	—	+
Vardø		+

On comparing the values at the stations from Fredrikshald to Skudenes, it will at once be seen that the downpour was generally above the normal in the years 1886—95, below, in 1896—1902. The exception which is found at Mandal is of no consequence, as the surplus above the normal in 1896—1902 is exceedingly small, in comparison to the difference between the average height of downpour in the series of years mentioned.

If we next investigate the results of the herring fishery in the Skagerack, we find that the Swedish Bohus fishery shows considerable increase in the years 1886—95, with a succeeding decrease up to the present time. In 1886—95 the catch of fish in Eastern Norway was, as a rule, good, and at times very plentiful. In 1893, the culminating point was reached with a catch of 337000 Hl. But from 1896—1902 the herring fishery in the same district was poor.

It will be found that the winter herring fishery, both in the North Sea and Norwegian Sea off the coast of Norway, had a different result. As will be seen, on reference to the tables, there was a surplus downpour both in 1886—95 and 1896—1902 from Skudenes to Kristiansand and Trondhjem, but it was very slight at the two last mentioned places, so that no decided effect can be expected there. On the other hand, on the coast southwards from Aalesund, a considerable surplus during both periods, greatest during the years 1896—1902, will be noticed. These facts harmonize well with the particularly successful spring-herring fisheries from 1896 onwards, the catches in the previous period, 1886—95, being unimportant in comparison. And, as is well known, it is also from 1895 onwards that there has been herring fishery in the Romsdal district.

During the years 1896—1902 then, the downpour on the Skagerack coast was on an average below the normal, and in the spring-herring district considerably above the usual average; at the same time, the springherring fishery flourished, and that in the Bohus and East Norwegian districts decreased.

It has long been affirmed that there is an alternation between the winter-herring fishery in the Skagerack and the Norwegian springherring fishery, so that when the curve for the latter reaches its maximum, the other is at a minimum, the highest point for the one corresponding to the lowest for the other. As far as can be seen from the historical notices of the fisheries, this interchange would appear to be almost an unbroken rule, which does not, however, prevent the possibility of there being s o m e catch of fish at one and the same time both on the Bohus and the West Norwegian coasts. In the light of my hypothesis, of the definite influence of the pressure of the atmosphere on the fisheries, an explanation may be sought in the fact that the barometrical minima which compel winds and currents to send the herrings into the west coast of Norway, cannot at the same time act similarly on the south Norwegian and Bohus coasts.

From what has now been advanced, it follows that the influences which are favourable to an inflow of herrings along a given stretch of coast will obstruct the passage of the cod landwards.

Let us, therefore, have a look at the results of the cod fishery. That which is carried on in the springherring district (Stavanger and the Bergenhus counties) yielded, during the years 1886—95, about 3 million fish, calculated from the official statistics; for the years 1896—1902, the average was about 1 million.

In the Romsdal district, where big herring fishery has been flourishing since 1895, I have calculated the average yield of cod to be 7.9 millions during the years 1886—95, and about 6.5 millions for the years 1896—1902. Thus, in both these districts, an increase in herrings and a decrease in cod have gone together. On reference to the tables, it will be seen that the stations at Kristi-

ansund and Trondhjem show, for the years 1896—1902, as compared with 1886—95, an average downpour which is not very unlike or much above the normal height. During the years 1896—1902 the downpour was below the average at Nordøerne, Brønnø and Sandnessjøen. So that we should expect to find an improvement in the cod fishery in the Trondhjem district and on the coast of Nordland south of the Vest Fiord, and statistics prove that this was actually the case; for I have calculated, from the official statistics, that the average yield in 1886—95 was about 2 millions, from 1896—1902 about 3. In the district where the largest cod fishery is carried on, it is interesting to notice that there was an usually high average downpour in the „bad" years 1896—1902, while the „good" fishing seasons are characterized by very little downpour. And, as already mentioned, the average yield of the Lofot fishery in the years 1886—95 was 26.5 millions, but from 1896—1902 only about 16 millions. Thus, there does appear to be a connection between the downpour, on the one hand, and the cod and herring fisheries, on the other.

In judging the various fisheries, a much too important part has hitherto been given to the natural animal instinct, while, on the other hand, it would be incorrect to attribute all the chief phenomena connected with the fisheries to purely hydrodynamic conditions. Especially with regard to the cod, it should be mentioned that if everything depended upon the mechanics of the water layers, one would also expect to find younger individuals than fully sexually developed ones at the spawning places. Dr. Hjort has shown that spawning principally takes place on the banks, less in the clay channels, so that *Gadus callarias* must, undoubtedly, possess some degree of initiative. But it can hardly be denied that the currents in the sea exert a very modifying influence on the movements of the fish. From this point of view, it becomes of considerable interest to have a clear knowledge of the causes of these currents. But on this matter, there is no little disagreement. Some scientists assert that the rotatory motion of the earth is alone necessary to cause the system of currents taken as a whole. But even if this be so, it can be said that the influence of the rotatory motion of the earth, whether it be great or small, must at any rate, be constant, and when one is trying to discover the causes of fluctuations in the fishery-yield, one must especially examine the variable factors which may be supposed to exert some influence. And then, I think, the winds must first of all be considered. As variations in atmospheric pressure cause winds, winds cause currents and currents, with great probability, exert an influence on the course of herrings and cod, it must certainly be practical to turn one's attention to the barometrical minima. In the foregoing pages, I have considered that the downpour will generally be influenced both by the situation and the degree of prominence by which they are characterized. In the meantime, it is interesting to consider these minima direct.

It may now be taken for granted that the great atmospheric depression, which is called the winter minimum, in the Norwegian Sea is subject to considerable variations, both with respect to place and degree. In „The Book on Norway", Einar Haffner describes the variations in atmospheric pressure in the years 1884 and 1890. Haffner also gives charts showing the distribution of atmospheric pressure, respectively in January 1884 and December 1890. The former shows a low pressure north of Norway, and the result was that January 1884 was unusually mild. In the chart for December 1890, this northern minimum has disappeared, the lowpressure centre near Iceland determined the direction of the winds, and in the month in question the temperature was very low over the whole of the Scandinavian peninsula. In „Ymer" for 1898 (Nr. 2), Otto Pettersson has described how the great development of the Gulf Stream, in the northern part of the Norwegian Sea in the summer of 1897, caused a winter minimum to the N.W. or N. of Norway. In consequence of this, there was a higher average temperature in Sweden in January and February 1898, on account of the prevailing westerly winds. As a whole, several winters from 1896 onwards have been unusually mild, while the summers have, to some extent, been cold, at any rate, in the north. There have also been „green" years in the same period. Another peculiar feature in connection with these years, is that some arctic mammals have come far south during the spring and summer (*Phoca groenlandica* and *Delphinapterus leucas*). But of greatest interest is the fact that there was a much smaller yield of cod than usual, in these years. If the theory, advanced in the foregoing, be adhered to, with respect to the dependence of this fishery upon winds and currents, a natural explanation of the decrease in the Lofot yield will be found in the fact of the atmospheric winter depression in the Norwegian Sea having been so marked and so situated as to make the system of currents, set in motion by the wind, act as an obstacle to the progress of the fish.

It is possible, too, that this way of looking at things, may throw new light upon the subject of the changes in the height of our coast water.

According to Dr. Andreas Hansen, the variations in the height of coast water have been above and below a settled medium, and the result, in historical times, has been that the relation between land and sea on the coasts of the North Sea and the Norwegian Sea has remained unaltered. It might perhaps be practical to introduce the idea of a medium normal height of water, which would correspond to the normal height of downpour for a given stretch of coast. The medium annual height of water, according to Andreas Hansen falls into groups of years in which it is above, and years in which it is below the normal height. In Røst 1891—94 he mentions a lesser height than usual, but in 1890 at Skagerack a greater.[1]) This answers particularly well to the circumstance that on the Skagerack coast in the period 1886—95 there was a surplus downpour, while on the northern coasts the average was not attained. For, as both downpour and water-level depend upon the direction and force of winds, they must have a corresponding course, and the measure of the one may, therefore, serve to judge of the other. It is also probable that just as the water on the Skagerack coast and the west coast of Norway may be in different phases, as proved by Hansen, so may there also be places, on the long stretch of coast from Skudenes to Vardø, where the water is higher than the normal height, while at others, it is lower. There is reason to suppose that, in the years 1896—1902, the medium water-level was lower than usual on the coast of Helgeland, and probably also on the coasts of the Trondhjem district, for the table shows that the downpour was below average.

If events should prove that my opinion, concerning the influence of atmospheric pressure upon the yield from the fisheries,

[1]) Cf. Skandinaviens Stigning, p. 52. Norges geol. Unders. Aarb. f. 1896—99.

is well founded, it is at the same time settled that an increased interest will be attached to the question of the causes of, and laws governing, atmospheric pressure. But this is an exceedingly difficult problem, for, as an English scientist, F. W. Harmer[1]), says: — „It seems impossible in these questions to distinguish between cause and effect. Temperature, pressure, winds and ocean currents act and react upon each other as links in an endless chain."

It is evident that, if the connection referred to really does exist, an important advance in weather prognostications will also be of some weight with regard to the prediction of the fisheries. And it would then be a reasonable supposition that an investigation of the distribution and degree of heat of the Gulf Stream in the Norwegian Sea, in December, for instance, would provide material which would make it possible to get an idea of the prospects for the subsequent Lofot fishery. Similarly, it may be supposed that, if the fluctuations in the fisheries were given a place in the group of phenomena, which vary during the so-called „Brückner Periods", a helpful plan of the rise and fall which occur in the fisheries might be obtained, by means of the historical-statistical method.

One is then tempted to conclude with regard to the Lofot fisheries that as the years 1886—95 were unusually favourable, it is not likely that the present marked poor yield of cod can last much longer, a change for the better must soon occur. It is, however, a fact that the changes in climate hardly occur with the regularity which the word „period" demands. In the last edition of his Meteorology, Mohn writes (p. 302): — „Beyond the daily and the yearly period in the course of the meteorological elements, we know no other period in the weather changes. One day, the one year, is not like the same day, another year, one month, the one year, is not like the same month another year; there is,indeed, a variation from one year to another in the weather, which seems quite irregular."

But on the other hand, the circumstance that bad years, — as well as good years, — both on land and at sea are inclined to follow each other, would seem to modify the supposition that there is an interchangeable tightening and slackening in the play of forces. At any rate it will be exceedingly interesting to follow the working out of the problem: — Are there periods of years which are characterized by great downfall, high medium water-level, good winter herring fishery, less good cod fishery, cold summers, with sometimes „green" years for the farmer; and are there periods of years when there is little downfall, low medium water-level, good cod fishery, less good herring fishery, dry and warm summers, with sometimes „dry" years for the farmer?

With regard to the special problem here being dealt with, what has already been said will, I hope, make it clear that there seems to be an agreement between the yield of the cod and herring fisheries and the winds, for whose influence the downfall has been used as a measure. To this method may be objected that the cod and herring fisheries are carried on in certain months, while the calculations of the downfall are made for the whole year. But it should be noticed that those months, in which these fisheries are carried on, are the richest in the year in downfall. Consequently, there will hardly be any real difference in results on account of the method here adopted. It might, however, perhaps be found that the agreement between the winds and the yield would be greater, even in details, if the downfall for the months September—December were taken in conjunction with the downfall in the months of January—April in the succeeding year. Any very detailed agreement must not, however, be expected, as the catch for a single year is only an unreliable measure of the actual quantity of fish present.[1])

The observations of downfall are of comparatively recent date in our country, consequently they can only be used as a measure of the effect of the winds, during recent years. But there are other things which give hints as to the conditions previously. During the last period of years in which there was a surplus downfall, a storm flood occurred in Lofoten and caused much damage. Richard Hansen writes about this, as follows: — „During the week, 19th—26th January (1901) a violent storm of wind from southwest to northeast raged; and on the 22nd, there was such high water that it was unparallelled in the memory of the oldest inhabitants, and much damage was done by this unusually high flood all along the Lofoten district."[2]) This kind of damaging flood will probably only occur in years with great downfall and high average water-level, so that the mention of such a flood makes it possible to draw conclusions with regard to the weather and matters connected with it. When, for instance, Absalon Pederssön, in his diary[3]) mentions that on November 1st 1570 „a very great and high flood occurred, whose equal no one in Bergen remembered and which did great damage to flour, malt and fish," one might from this circumstance conclude that herring catch was made during these years. From Christmas 1570 to February 1571 there was according to the same writer, severe frost, and the herring fishery that year was a failure, but the next year (1572) herrings were caught in the beginning of February, and in the years preceeding 1570 in February herrings were regularly to be had in the Bergen market. From several sources, we find that the years 1740—42 were „bad" ones or „green" years. Professor Hans Strøm, in his well-known description of Søndmør, mentions that spring-herring fishery was started there about 1740, „that is to say about the same time as the general failure of crops occurred in Norway." And at another place, in the same work, he says that the summer is generally short and warm, but „from 1740 the summer here has generally been cold and damp with thick fogs, which have continually come in from the sea and brought a cold northerly, or westerly, wind in its wake." Here we have a clear combination of bad weather and inflow of spring-herrings, and this is not the only example of its kind. The first „green years" mentioned in our history occurred during the reign of Harald Graafeld (961—970), and were exceedingly bad. Snorre relates that „the country people were almost entirely without grain and fish". At Helgeland, there was great hunger and want. Øivind Skalde-

[1]) Influence of winds upon climate during the pleistocene epoch. Quart. Journ. Geol. Soc., vol LVII, 1901, p. 457.

[1]) After this was written, J. Rekstad's interesting treatise on the changes in Norwegian glaciers was published („Om Justedalsbræen" Berg. Mus. Aarb. 1904). Rekstad comes to the conclusion that temperature exerts a greater influence than downfall on the changes in the glaciers, and in the course of his investigations, he has compared the downfall curves for the period 1st May—1st September, and from September—May. He says (l. c. p. 70): „On considering the anual curves and those for the 8 winter months, it was found that they (downfall curves) pretty closely corresponded. When the annual downfall was great, the same was the case in the winter months; and when the annual downfall, on the contrary, was small, the corresponding was found to be true, with regard to the winter months."

[2]) Norges Fiskerier 1901, Nr. 2, p. 109.

[3]) Cf. Nicolaysen's edition (1860), p. 203.

SPILDER, who lived at Tjøtta, wrote about the common misery, and he too was a great sufferer during the bad years. One spring, there was an inflow of herrings to some outlying places, and ØIVIND rowed thither to buy some. SNORRE further writes that „the first winter (970—971) that HAAKON JARL ruled in Norway, herrings came around the whole country." We see, that, at this time too, bad years and inflow of herrings were coincident, and I am, moreover, inclined to conclude that, as there was such hunger and want at Helgeland, the cod fishery had not been successful. SNORRE indeed says that there was a want of fish. We know that, about a hundred years previously, the Lofot fishery had been so good that a man at Helgeland had been able to export stock fish to England.

Right back in the olden days, there are sources of information which hint at considerable variations in the yield of the Lofot fishery. And at the present day, we have certain proofs that rather great fluctuations do indeed occur.

To confirm which, I will, finally, give a few features of the history of the Lofot fishery in the 19th century. At the commencement of the century in question, there were many bad years for the farmer, 1812 being one of the worst. From an account written at the time[1]), it will be seen that the Lofot fishery had so fallen off that it was feared that it would altogether fail, and the reason for this was not sought in natural circumstances, but in the increasing use of nets during the fishing season.

About ten years later, there appears to be an improvement in the fishery. The clergyman in Saltdalen, S. C. SOMMERFELDT[2]) writes that, in the year 1823, there was a particularly good Lofot fishing season, and the yield was calculated to be 15,923000 fish, divided among 2788 boats. For the succeeding years the following figures are given by JENS KRAFT[3]) for Lofoten and Vesteraalen.

	Nr. of boats.	Nr. of fish.
1825	— 2589 —	11509180.
1826	— 2790 —	12821760.
1827	— 2916 —	15864620.
1828[1])	— 2734 —	13919380.
1829	— 3027 —	14676200.

These figures, according to A. M. SCHWEIGAARD[2]) are too low, as the fishers were supposed to have given too low numbers, on account of tithes to be paid. As, however, the yield from Vesteraalen[3]) is also included in these figures, the yield for Lofoten alone can hardly be said to be more than 15 millions.

From 1859, there are complete reports of the Lofot yield.

A graphic illustration of the millions caught from 1859—1903 gives a particularly irregular picture, suggesting a panorama of Jotunheim, with a Galdhøpig for the maximum year.

It is evident that the catch of a single year may, to some extent, be affected by more or less accidental factors, whose influence must be supposed to be disregarded when an average for a period of years is to be given, e. g. a decennium.

The result would then be: —

1861—75	.... 18.4	million fish	
1876—85	.... 24.5	—	„
1886—95	.... 26.5	—	„
1896—1903	.... 15.4	—	„

These figures are supposed to be comparable.

It is interesting to note that during the years 1861—74, there was a big-herring period in Nordland. At the same time, the average water-level is mentioned as being higher than normal, and the yield of cod must be reckoned as not very good. The next period shows an improvement in the yield, and the best seasons are reached in the years 1886—95. This agrees beautifully with a low average water-level in Nordland in the years 1891—94, and a downfall less than usual in the same decennium. On the contrary, as already mentioned, the Lofot fishery has of late years not been very good, while there has been a surplus downfall.

c. Some Remarks on the Cod-fishery in Finmark.

The catch of spawning cod (skrei) in Finmark is not very important, at any rate at the present time. Spawning takes place, however, every year and Brevik and Hasvik in Sørøen are important stations during the winterfishery in Finmark. A. F. BREMER[4]) mentions that, about 1830, there was a very good catch of „skrei" in the fiords of West Finmark, in particular in the Alten Fiord. But in 1838 a change occurred, and from that year the fishery in the fiords was poor, and the reason BREMER thought, was that the considerable inflow of *Ommatostrephes todarus* (akker) and herrings began just that year. BREMER, and others, also mention that from 1830—40 the „loddefishery"[5]) was very poor. It is mentioned as a general rule that the winter cod fishery in Finmark is always better in those years when the „lodde" (capelan) occurs only in small numbers. The spring cod-fishery, which depends upon the capelans being followed on its spawning travels by young individuals of *Gadus callarias*, is very much more important than the winter fishery (skrei-fishery), therefore the absence of capelan is a serious matter for the Finmark fishers economically speaking. It would therefore be of great economical importance to get a thorough knowledge of the capelan's life. In one of his latest works, Prof. COLLETT[4]) has collected what is up to the present known about this fish. I beg to refer to this account, from which it will be seen that „during the inflow, the capelan often travels in compact shoals in the surface layers". Sometimes, spawning occurs at a depth of a few meters, but generally deeper down (70—90 m.).

[1]) E. A. COLBAN, Forsøg til en Beskrivelse over Lofotens og Vesteraalens Fogderi (1814). Det Kgl. norske Vid. Selsk. Skrifter i 19de Aarh., Bd. 2, Trondhjem, 1824—27.

[2]) Physisk-økonomisk Beskrivelse over Saltdalen, p. 139. Det Kgl. norske Vid. Selsk. Skr. 19 Aarh. Bd. 2, Trondhjem 1824—27.

[3]) Beskrivelse over Kongeriget Norge, 6 Del, p. 373, Kristiania, 1835.

[4]) En gammel Finmarkings Betragtninger o. s. v. Hammerfest, 1881.

[5]) By this expression is meant the cod fishery which is carried on at the time when *Mallotus villosus*, MÜLL. (lodde) spawns.

[1]) Lofoten alone.

[2]) Norges Statistik, p. 96. Kristiania, 1840.

[3]) According to SOMMERFELDT (l. c. p. 139), the yield from Vesteraalen in 1823 was 581700 fish.

[4]) Meddelelser om Norges Fiske i Aarene 1884—1901, II. Kristiania Vid. Selsk. Forh. f. 1903, nr. 9, p. 147—163.

A glance at a curve depicting the yield of this fish (cf. Hjort, Hvalfangst og fiskeri, p. 81) gives the impression of great irregularity, without any sign of any rhythmical law. It must, however, be remembered that there are many things which affect the yield of a fishery. It cannot be denied that there are immense variations in the occurrence of capelan, and this cannot be supposed to be a whim on the part of the fish, but must depend upon variations in the natural conditions in the sea itself. When I visited Finmark, in 1899, M. Ingebrigtsen, the whale-catcher, told me that old fishermen took two things as signs of a good number of capelan, and these were (1) a plentiful supply of driftwood, and (2) a good ptarmigan year.

Carefully considered, it will be found that these two „signs" point to the fact that sea winds have been prevailing; for the drift wood is driven by wind and storm landwards, and prevailing winds from the ocean means a good deal of moisture which here falls as snow, and a good deal of snow in the mountains sends the ptarmigan down into the low lands. If it be taken for granted that the capelan, as well as the herring, is dependent upon the movements of the surface layers, my hypothesis would mean that in the years when there is a plentiful downfall, there would be large shoals of capelan. This does not, however, seem very likely from the statistics given for the years 1896—1902, during which period there was a surplus downfall, but only a poor yield of fish. But *Phoca groenlandica* occurred in large numbers in the years mentioned, and the presence of this animal was said to have a particularly bad influence on the fishery.

According to Bremer there was, from 1830—38, good skrei-fishing in the fiords of Finmark, but then *Ommatostrephes* and herrings showed themselves and the skrei diminished in numbers. The same writer says that the capelan, about the year 1840, again came in large numbers to the coasts of Finmark.

I have already shown that the „skrei"-fishery and the winter herring-fishery appear to depend upon contrary current-phases, and as the capelan's habits are, as far as is at present known, similar to those of the herring at the time of inflow, we must expect that the surface currents, which drive the capelan landwards, cause compensation currents further down, and these latter obstruct the inflow of „skrei". What I have just said must only be taken as an attempt at an explanation. It is, meanwhile, interesting that this attempt harmonizes with the prognostications made by old fishers in Finmark.

At any rate it would seem to be worth while to pay attention to those mechanical factors which may be supposed to exert an influence on the yield from the fisheries.

It is possible that it will be found that the large catches of herrings on the coast in the months of October—December, and to some extent also January, may be accounted for by the fact that meteorological conditions in these months cause a strong flow of water to the coasts, which is also evident from there being a maximum height of water in the autumn. And with regard to the spawning herring (vaarsild) and the spawning cod (skrei), I think I have found as a result of historical and statistical investigations, that, as a rule, a good herring fishery and a good „skrei"-fishery will not occur on the same stretch of coast, simultaneously. At the period these fisheries are carried on (January—April), there is a sinking tendency in the water towards the spring minimum, and it seems reasonable, that just as the relation between ocean and land winds at this time exerts an influence on the medium water-level, by regulating the currents in the coast water, so will its effect on the currents also, to some extent, further or hinder the inflow of cod and herrings. There can be no doubt that biological and physical factors play an important part in the fisheries. The former may be taken to be constant, while, at any rate, some, of the physical ones are variable.

If one takes it for granted that the ocean-currents have an important influence on the course of the fish towards land, the difficulty meets one that scientists are not agreed as to which of the causes of currents one should give most weight. Can it, however, be proved that there is a connection between the periodical changes in the yield of the fisheries and the fields, one will be compelled to suppose that there is a common cause at the bottom, and we have thus come to the conclusion that this must be the variations in atmospheric pressure. But we get no farther, and will hardly be able to do so, until meteorologists have solved the problem of the laws governing the rise and changes in barometrical minima.

As far as practical marine investigations are concerned, the following famous words of Laplace may well be used:—

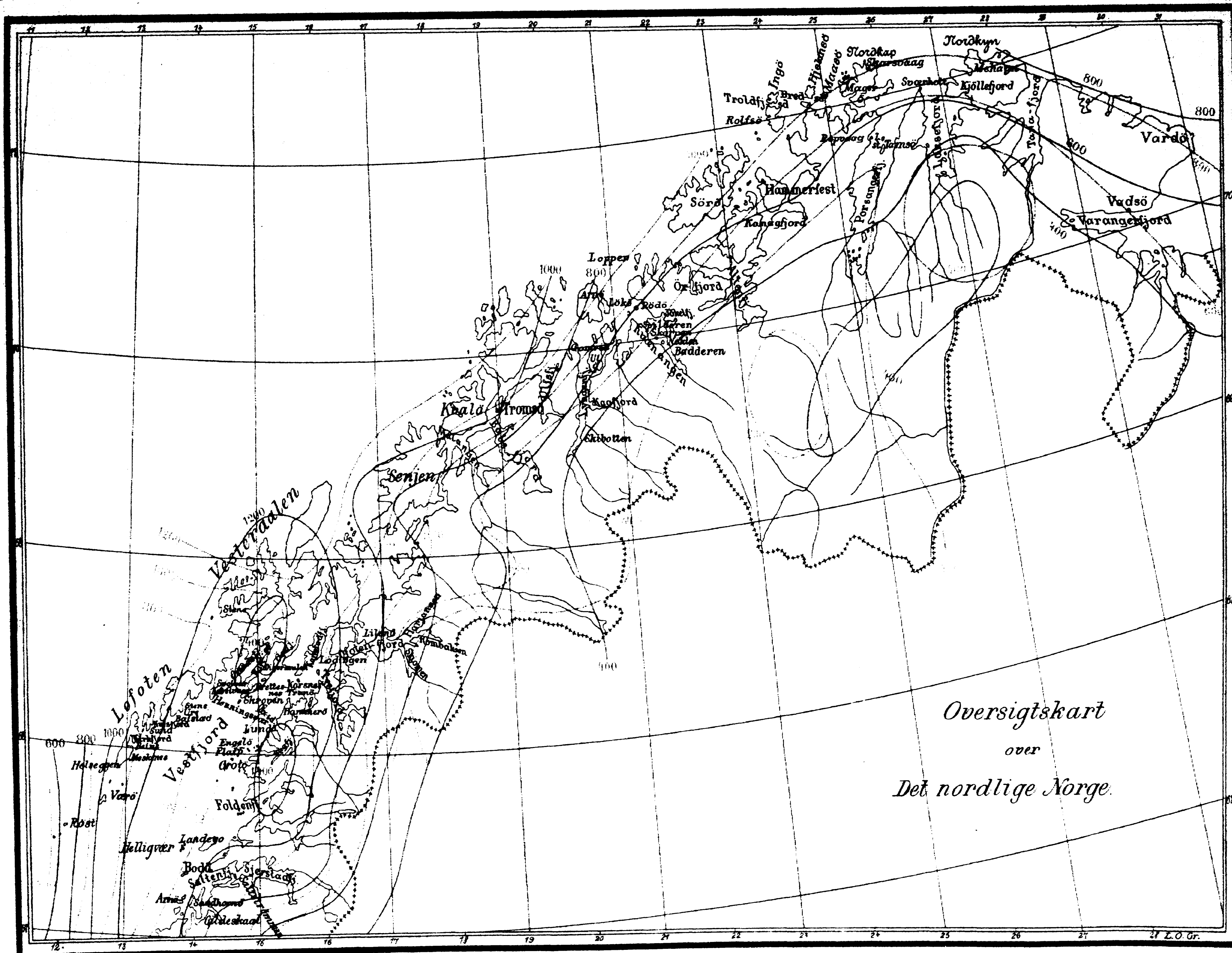
„Ce que nous savons est peu de chose, ce que nous ignorons est immense."

PLATE I.

PLATE I.

Map showing the northern part of Norway. The curves are isohyets and represent downfall in mm. for the year 1899 (blue) and 1900 (green).

Pl. I.



Oversigtskart
over
Det nordlige Norge
Nordkyn
Nordkap
Skarsvaag
Kjöllefjord
Ingö
Troldfj.
Rolfsö
Hammerfest
Kvalsund
Porsanger fj.
Vardö
Vadsö
Varangerfjord
Sörö
Loppen
Örkfjord
Arnö
Lökö
Rödö
Badderen
Kaafjord
Skibotten
Kvalö
Tromsø
Senjen
Vesteraalen
Lofoten
Lödingen
Ofotenfjord
Vestfjord
Lund
Grötö
Foldenfj.
Holsegjen
Værö
Röst
Helligvær
Landego
Bodö
Saltenfj.
Sjerstad
Arnö
Gildeskaal
Stene
Skrovan
Henningsvær
Hammerö
Engelö
Flatö
Moskenes
1000
800
600
400
L. O. Gr.
John Griegs Lith. Etabl. Bergen

PLATE II.

PLATE II.

Fig. 1—12. *Pleuromamma robusta*, DAHL, Skroven (Vestfiord), 0—300 m., $^{4}/_{3}$ 1899.

" 1. Anterior antenna, right side, $^{83}/_{1}$.

" 2. First joints of anterior antenna, left side, $^{83}/_{1}$.

" 3. Posterior antenna, $^{83}/_{1}$.

" 4. Mandible, $^{83}/_{1}$.

" 5. Maxilla, $^{83}/_{1}$

" 6. 1. Maxilliped, $^{83}/_{1}$.

" 7. 2. Maxilliped, $^{83}/_{1}$.

" 8. 2. pair of natatory legs, $^{83}/_{1}$.

" 9. 3. pair of natatory legs, $^{83}/_{1}$.

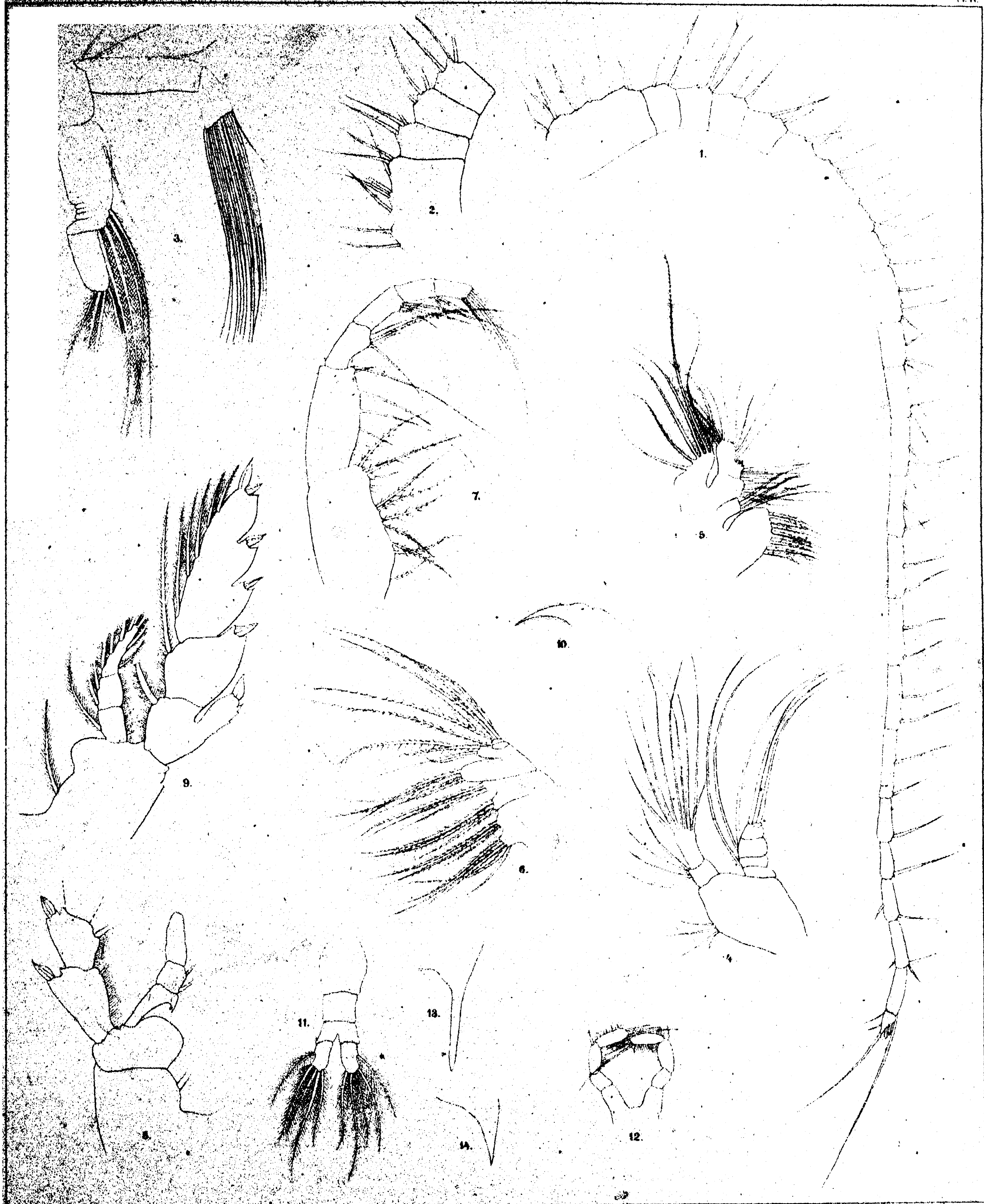
" 10. Rostrum, $^{83}/_{1}$.

" 11. Abdomen, $^{27}/_{1}$.

" 12. 5. pair of natatory legs, $^{83}/_{1}$.

" 13. *Chiridius tenuispinus*, G. O. SARS, female, Ofotfjord, 300—350 m., $^{7}/_{3}$ 1899.
Spine of the last segment of cephalothorax, $^{83}/_{1}$.

" 14. *Chiridius armatus*, BOECK, female, The Malang Fiord, 0—380 m., $^{14}/_{4}$ 1899.
Spine of the last segment of cephalothorax, $^{83}/_{1}$.



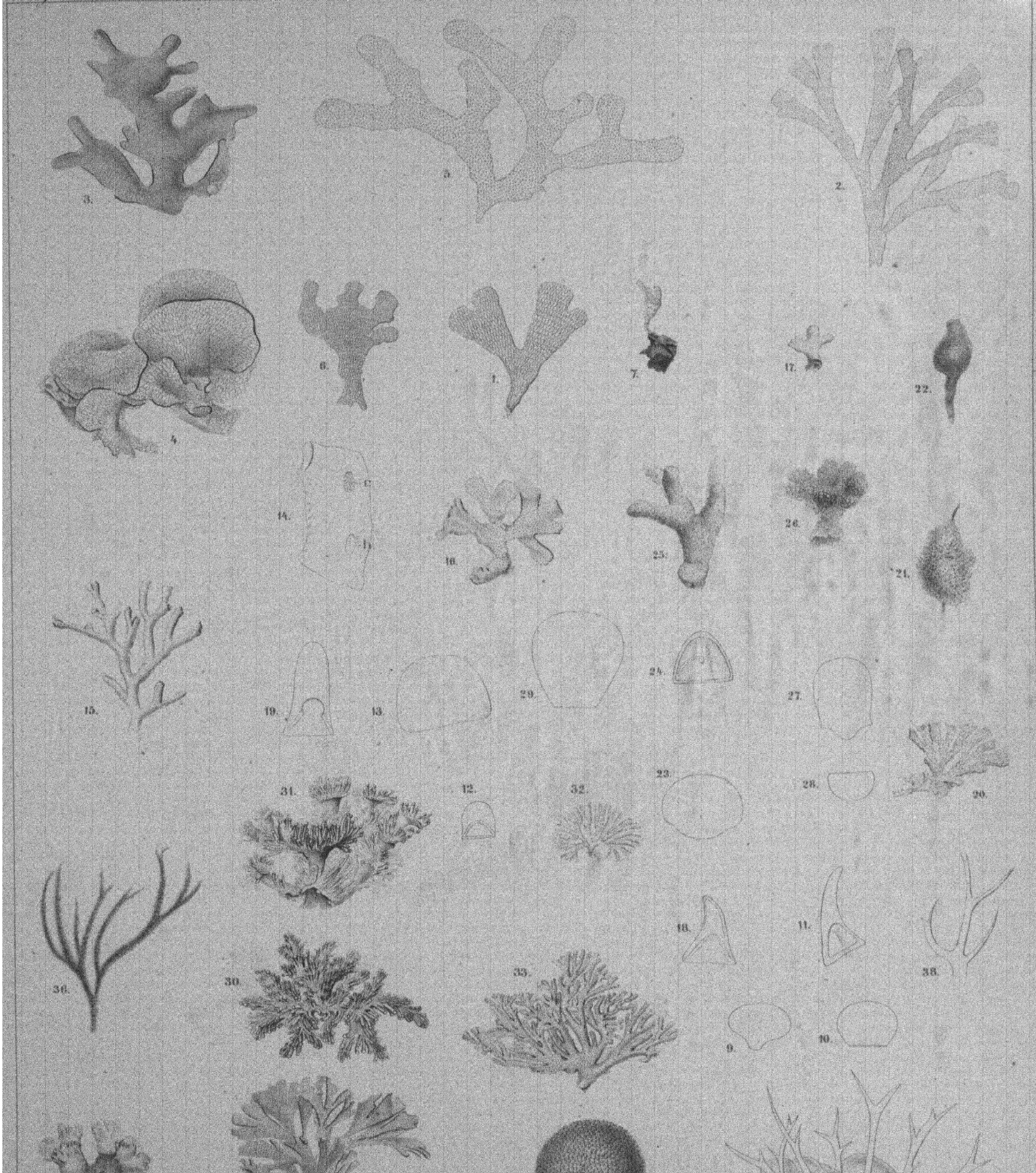
[illegible] del.

John Griegs Lith Etabl Bergen

PLATE III.

PLATE III.

Fig. 1. *Flustra carbasea*, ELLIS & SOL., Mehavn, 1894, $^1/_1$.
„ 2. *Flustra securifrons*, PALLAS, Breisund (Finmarken), $^1/_1$.
„ 3. *Flustra membranaceo-truncata*, SMITT, Skjerstad Fiord, $^1/_1$.
„ 4. *Flustra membranaceo-truncata*, SMITT, Mehavn, $^2/_1$—$^3/_1$.
„ 5. *Flustra barleei*, BUSK, Arnø (Vestfjord), 300—400 m., $^1/_1$.
„ 6. *Flustra barleei*, BUSK, Røst II, 150 m., $^{25}/_3$ 1899, $^1/_1$.
„ 7. *Flustra abyssicola*, M. SARS, on a little stone, Balstad, 150 m., $^1/_1$.
„ 8. *Bugula murrayana*, JOHNST., the typical form, from the „skjærgaard" outside Bergen, $^1/_1$.
„ 9. *Schizoporella sinuosa*, BUSK, Svolvær, 50—70 m., aperture of the zooecium, $^{83}/_1$.
„ 10. *Schizoporella sinuosa*, BUSK, Digermulen, 100—150 m., operculum, $^{83}/_1$.
„ 11. *Membranipora minax*, BUSK, Moskenstrømmen, mandible, $^{83}/_1$.
„ 12—14. *Eschara sincera*, SMITT, Nordkap, 1894.
„ 12. Mandible, $^{83}/_1$.
„ 13. Operculum, $^{83}/_1$.
„ 14. Zooecium, lateral view, r, rosetplate, h, hole, $^{17}/_1$.
„ 15. *Porella lævis*, FLEM., The Trondhjem Fiord, $^1/_1$.
„ 16. *Porella saccata*, BUSK, Nordkap, $^1/_1$.
„ 17. *Escharopsis rosacea*, BUSK, Moskenstrømmen, $^1/_1$.
„ 18. *Escharoides coccinea*, ABILDGAARD, Solsvik in the Bergen „skjærgaard", mandible, $^{83}/_1$.
„ 19. *Escharoides jacksoni*, WATERS, Kvænangen II, mandible, $^{83}/_1$.
„ 20. *Retepora wallichiana*, BUSK, young colony, Balstad, $^2/_1$—$^3/_1$.
„ 21—24. *Cellepora nodulosa*, LORENZ.
„ 21. Colony from Mehavn (Finmarken), $^2/_1$—$^3/_1$.
„ 22. Colony from the Norwegian North Atl. Exp., St. 273, $^1/_1$.
„ 23. An operculum of a colony from the Jøkel Fiord III, 100 m., $^{83}/_1$.
„ 24. A mandible of a colony from the Jøkel Fiord III, 100 m., $^{83}/_1$.
„ 25. *Cellepora incrassata*, SMITT, Hammerfest, $^1/_1$.
„ 26—29. *Cellepora ventricosa*, LORENZ.
„ 26. Colony from Breisund (Finmarken), 30—40 m., $^1/_1$.
„ 27. An operculum of the same colony, $^{83}/_1$
„ 28. Mandible of oral avicularium, $^{83}/_1$.
„ 29. Mandible of a spatulate avicularium, $^{83}/_1$.
„ 30. *Tubulipora liliacea*, PALLAS, Solsvik in the Bergen „skjærgaard", $^2/_1$—$^3/_1$.
„ 31. *Tubulipora* sp (? *penicillata*, FABR.), Mehavn (Finmarken), $^2/_1$—$^3/_1$.
„ 32. *Idmonea atlantica*, FORB., Hustadviken, outside Romsdals amt, $^1/_1$.
„ 33. *Hornera lichenoides*, PONTOP., the Porsanger Fiord, 200 m., $^1/_1$.
„ 34. *Domopora stellata*, GOLDF., the Malangen Fiord, 100—200 m., $^2/_1$—$^3/_1$.
„ 35. *Alcyonidium disciforme*, SMITT, the Lyngen Fiord III, the border a little ruptured, $^2/_1$—$^3/_1$.
„ 36. *Bowerbankia imbricata*, ADAMS, The Norw. North Atl. Exp., st. 343, $^1/_1$.
„ 37—38. *Flustrella corniculata*, SMITT, Svolvær (Lofoten), $^{27}/_1$.
„ 37. Zooecia, $^{27}/_1$.
„ 38. Spine of the same colony, $^{27}/_1$.



Nordgaard & Bucher del.

John Griegs Lith. Etabl. Bergen

PLATE IV.

PLATE IV.

Fig. 1—2. *Physophora borealis,* M. SARS, Moskenstrømmen, 0 m., 1/3 1899.
„ 1. Tentacular knob, $^{83}/_1$.
„ 2. Older tentacular knob, $^{83}/_1$.
„ 3—5. *Eschara moskensis,* n, sp., Moskenstrømmen II, 150 m.
„ 3. Zooecium, $^{52}/_1$.
„ 4. Ooecium, $^{52}/_1$.
„ 5. Operculum, $^{83}/_1$.
„ 6—7. *Schizoporella candida,* SMITT, The Malangen Fiord, 100—200 m.
„ 6. Zooecium, $^{52}/_1$.
„ 7. Operculum, $^{83}/_1$.
„ 8—11. *Porella proboscidea,* HINCKS, The North Cape.
„ 8. Zooecium, lateral view, a. a = avicular aperture, r. p = rosette-plate, h = hole, $^{52}/_1$.
„ 9. Mandible, $^{83}/_1$.
„ 10. Operculum, $^{83}/_1$.
„ 11. Oral aperture, the condyles are seen, $^{83}/_1$.
„ 12. *Palmicellaria skenei* var. *tridens*, BUSK, Radøsund, a little north of Bergen, 100 m., operculum, $^{83}/_1$.
„ 13. *Palmicellaria skenei* var. *bicornis,* BUSK, Jøkel Fiord III, 100 m., operculum, $^{83}/_1$.
„ 14—15. *Monoporella spinulifera,* HINCKS, Hammerfest.
„ 14. Ooecium and oral aperture, $^{52}/_1$.
„ 15. Zooecium, lateral view, $^{52}/_1$.
„ 16—17. *Schizoporella reticulato-punctata,* HINCKS, The Porsanger Fiord, 200 m.
„ 16. Ooecium with the upper part of the zooecium, $^{52}/_1$.
„ 17. Operculum, $^{83}/_1$.
„ 18—20 b. *Porella propinqua,* SMITT, Nordkap (1894).
„ 18. Zooecia, lateral view, a. u, avicularian umbo, o, ooecium, r. p, rosette-plate, $^{52}/_1$.
„ 19. The back side of the zoarium, $^{52}/_1$.
„ 20 a. Operculum, $^{83}/_1$.
„ 20 b. Ooecium, $^{83}/_1$.
„ 21—23. *Porella princeps,* NORMAN, Mehavn (1894).
„ 21. Operculum, $^{83}/_1$.
„ 22. Mandible, $^{83}/_1$.
„ 23. The under side of the front wall of the zooecium, showing the avicularian chamber (a. c) and the lateral channels (c h), $^{52}/_1$.
„ 24. *Smittina smitti,* KIRCHENP., The Øgs Fiord I, 100 m., ooecium and the upper part of the zooecium, $^{52}/_1$.
„ 25—26. *Escharella labiata,* BOECK, Svolvær, on coal.
„ 25. Zooecium, lateral view, $^{83}/_1$.
„ 26. Base of the ooecium, $^{83}/_1$.
„ 27. Oral denticle of *Escharella immersa,* FLEM., Moskenstrømmen, $^{83}/_1$.
„ 28. —:— — *ventricosa,* HASS., Hammerfest, $^{83}/_1$.
„ 29. —:— — *laqueata,* NORM., Hammerfest, $^{83}/_1$.
„ 30. —:— — *abyssicola,* NORM., The Bømmel Fiord, $^{83}/_1$.
„ 31. —:— — *labiata,* BOECK, Svolvær, $^{83}/_1$.
„ 32—35. *Eschara nordlandica*, n. sp., The Kvænang Fiord, 90 m.
„ 32. A young zooecium and ooecium, $^{52}/_1$.
„ 33. Oral aperture of the zooecium, c, condylus, r, opercular rib, $^{83}/_1$.
„ 34. Ooecium, $^{83}/_1$.
„ 35. Operculum, $^{83}/_1$.
„ 36—38. *Smittina majuscula,* SMITT, The Porsanger Fiord, 90 m.
„ 36. Zooecium and ooecium, $^{52}/_1$.
„ 37. Operculum, $^{83}/_1$.
„ 38. Mandible, $^{83}/_1$.

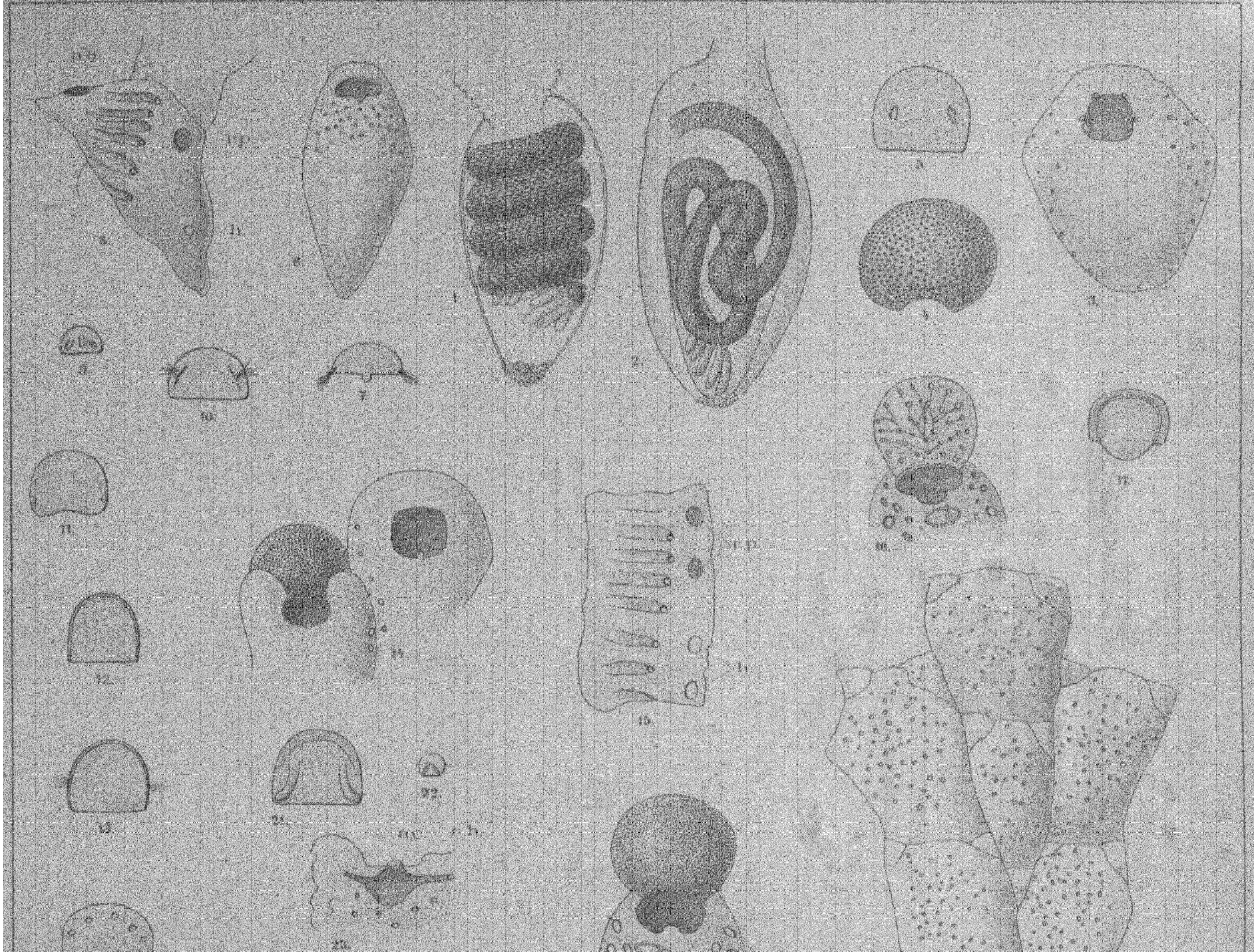

a.a.
r.p.
h.
8.
6.
1.
2.
5.
4.
3.
9.
10.
7.
16.
17.
11.
14.
r.p.
h.
15.
12.
13.
21.
22.
a.c.
c.h.
23.
24.
26.
19.
o.
31.
25.
35.
20. b.
20. a.
30.
29.
28.
27.
32.
34.
r
c
33.
a.u.
r.p.
o.
p.s.
18.
38.
37.
36.

PLATE V.

PLATE V.

Fig. 1—2. *Schizoporella stormi*, n. sp., The North Cape (1894).

„ 1. Zooecia, $^{52}/_{1}$. The avicularia are not quite correct, as the mandibles are more pointed than in the figure.

„ 2. Operculum, o. r, opercular rib, $^{83}/_{1}$.

„ 3—4. *Schizoporella levinseni*, n. sp., Kvænangen II, 90 m.

„ 3. Zooecia, $^{52}/_{1}$.

„ 4. Operculum with the proximal margin of the oral aperture, $^{83}/_{1}$.

„ 5—7. *Porella glaciata*, WATERS, Mehavn (1894).

„ 5. Zooecia, $^{52}/_{1}$.

„ 6. Operculum, $^{83}/_{1}$.

„ 7. Mandible, $^{260}/_{1}$.

„ 8—11. *Rhamphostomella scabra*, FABR., The Porsanger Fiord, 70 m.

„ 8. Zooecium, $^{52}/_{1}$.

„ 9. Oooecium, $^{52}/_{1}$.

„ 10. The back side of the zoarium, $^{52}/_{1}$.

„ 11. Mandible, $^{83}/_{1}$.

„ 12—13. *Schizoporella hexagona*, n. sp., Kvænangen II, 90 m.

„ 12. Zooecia, $^{52}/_{1}$.

„ 13. Operculum, $^{83}/_{1}$.

„ 14—15. *Rhamphostomella plicata*, SMITT, Nordkyn (1894).

„ 14. Ooecium with the upper part of the zooecium, $^{83}/_{1}$. The two small denticles, one on each side of the large one, are not illustrated.

„ 15. Mandible, $^{83}/_{1}$.

„ 16—17. *Rhamphostomella radiatula*, HINCKS, The North Cape (1894).

„ 16. Ooecium and oral aperture, $^{83}/_{1}$.

„ 17. Part of the frontal wall of the zooecium, $^{83}/_{1}$.

„ 18—20. *Rhamphostomella contigua*, SMITT, The Østnes Fiord, 50—70 m.

„ 18. Zooecium, $^{52}/_{1}$.

„ 19. Operculum, $^{83}/_{1}$.

„ 20. Mandible, $^{83}/_{1}$.

„ 21—22. *Rhamphostomella costata*, LORENZ, Tromsø.

„ 21. Ooecium, $^{52}/_{1}$.

„ 22. Oral denticle, $^{83}/_{1}$.

„ 23—25. *Schizoporella unicornis*, JOHNST., Glea (Røst).

„ 23. Zooecia, $^{52}/_{1}$.

„ 24. Operculum, $^{83}/_{1}$.

„ 25. Mandible, $^{83}/_{1}$.

„ 26. *Schizoporella linearis*, HASS., Bognøstrømmen (Bergen), 30—50 m., operculum, $^{83}/_{1}$.

„ 27. *Schizoporella unicornis*, JOHNST., The Hjelte Fiord (Bergen), operculum, $^{83}/_{1}$.

„ 28—31. *Phylactella peristomata*, n. sp., Jøkel Fiord II, 80 m.

„ 28. Zooecium with marginal pores, p. a. c, pores to the avicularian chamber, $^{52}/_{1}$.

„ 29. Zooecia, s, shield beneath the oral aperture, $^{52}/_{1}$.

„ 30. Mandible, $^{260}/_{1}$.

„ 51. Oral denticle, $^{83}/_{1}$.

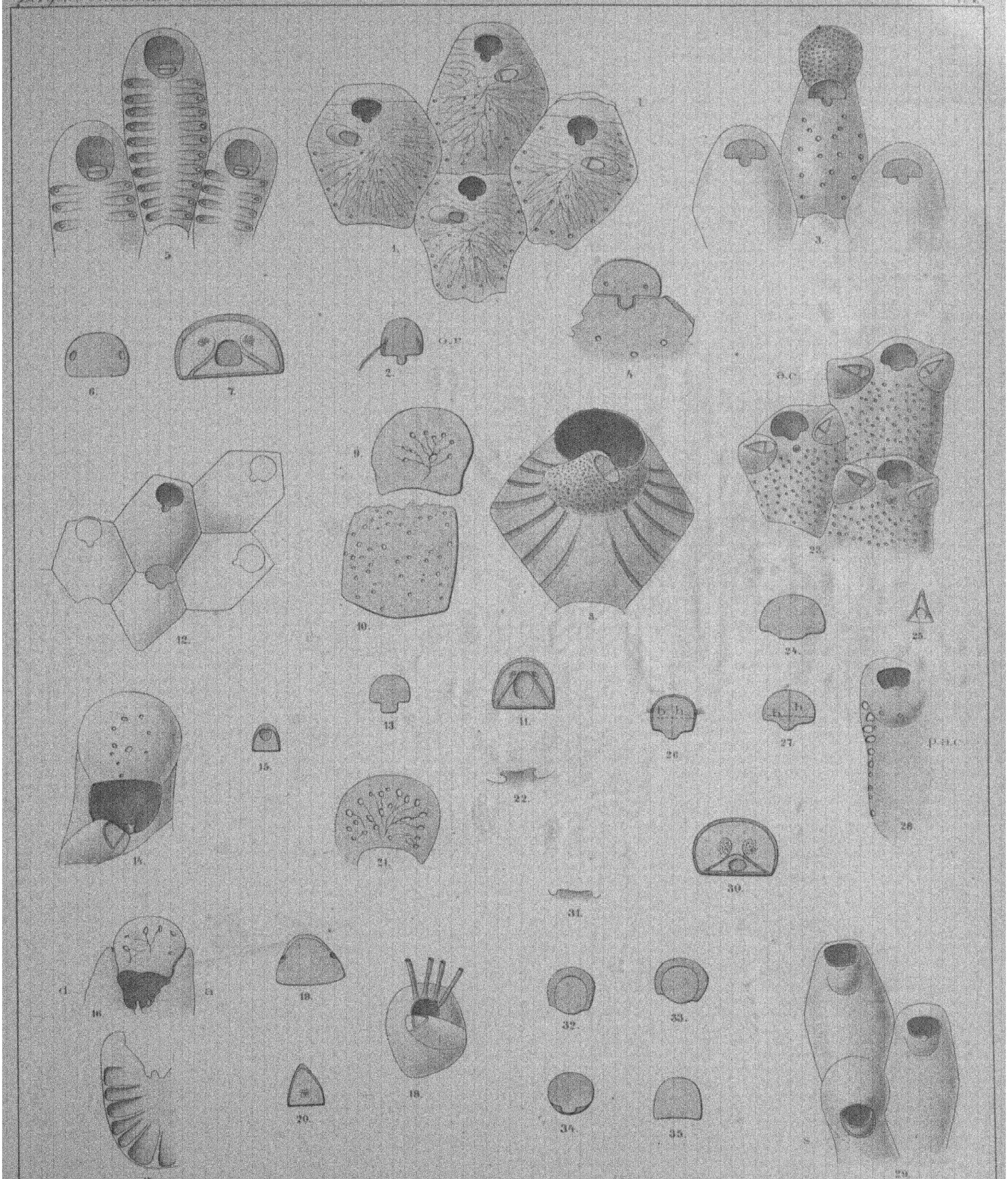
„ 32. *Schizoporella porifera*, SMITT, Napstrømmen (Lofoten), operculum, $^{83}/_{1}$.

„ 33—34. *Schizoporella lineata*, NORDG., Nordkyn (1894).

„ 33. Operculum, $^{83}/_{1}$.

„ 34. Oral aperture, $^{83}/_{1}$.

„ 35. *Smittina trispinosa*, JOHNST., Balstad (Lofoten), operculum, $^{83}/_{1}$.



Nordgaard del.

PLATE VI.

Fig. 1. *Coscinodiscus centralis* EHRB.; RATTR. Valve in side view, $^{450}/_{1}$.

„ 2. *C. subbulliens* JØRG. n. sp. Sample from Evenstad (near Helseggen, Lofoten) II, $^{1}/_{3}$ 1899, 0—200 m. Valve in side view, $^{450}/_{1}$.

„ 3. *Thalassiosira decipiens* (GRUN.), $^{950}/_{1}$.

a. The Skjerstad Fiord V, $^{2}/_{4}$ 1900, 0—420 m. The odd, asymmetrical, spine is distinctly seen (as also in the figures b—e). The structure is very difficult to draw with a satisfactory result. There are some errors in the reproduction, especially in the median part of the valve. When, however, the drawings are compared with the description they will, I hope, nevertheless be of some use. The lines are meant to show the direction of the rows of areoles; some of these are also illustrated.

b. The Herlø Fiord near Bergen, $^{15}/_{3}$ 1898.

c. Følstad (the Østnes Fiord, Lofoten), $^{4}/_{4}$ 1899, 0—3 m. Only the spines are shown in the figure.

d. The Herlø Fiord, $^{15}/_{3}$ 1898. A valve in side view, showing the long, somewhat curved, marginal spines and the high marginal zone.

e. The Vest Fiord (Lofoten), $^{30}/_{3}$ 1900, 0—25 m. A cell (frustule) in side view. The common forms are generally lower.

f. *Orthosira angulata* GREG. Diat. of Clyde, pl. X, figs. 43 and 43 b, $^{400}/_{1}$.

„ 4. *Thalassiosira gravida* CL. A piece of a chain, $^{450}/_{1}$, showing the mucilaginous threads after staining with methylene blue.

„ 5. *Th. hyalina* (GRUN.) GRAN.

a—c. Valves of different specimens from Følstad, $^{4}/_{4}$ 1899, 0—3 m., $^{950}/_{1}$. The very fine structure is not illustrated, but only the marginal spines, in b and c only that part of the valve where the odd, asymmetrical, spine is found. In the figure a the more coarsely punctate median part is also shown.

d. Gaukværø, $^{11}/_{4}$ 1899, 0—3 m. A chain, $^{660}/_{1}$, showing the long mucilaginous threads of which only the outermost are illustrated. The central connecting band is a little too thick in this figure.

„ 6. *Th. kryophila* (GRUN.). Cape Wankaroma (North Eastern Siberia, Vega Expedition; slide in the Riksmusæum, Stockholm).

a, b. Valves of two different specimens, $^{660}/_{1}$. Only a part of the border with marginal spines and the odd one are here shown.

„ 7. *Porosira glacialis* (GRUN.). a, b, d from Stene in Bø (Vesteraalen), $^{10}/_{4}$ 1899.

a. 2 cells, connected by a thick mucilaginous band, $^{330}/_{1}$. Outside this band two isolated connecting threads are seen.

b. 2 cells with protoplasma and chromatophores (conserved in formaline), $^{330}/_{1}$.

c. A 3-jointed chain with very thick connecting bands, $^{450}/_{1}$. A specimen from the Arctic Sea 1898.

d. A 3-jointed chain, $^{660}/_{1}$, showing the long, diverging mucilaginous threads (after staining with methylene blue).

„ 8. *Eucampia groenlandica* CL. Part of a chain, $^{660}/_{1}$. Brettesnes (Lofoten), $^{4}/_{4}$ 1899. The transverse lines are much finer than represented in the figure.

„ 9. *Fragilaria cylindrus* GRUN. A valve of a small and short specimen, $^{950}/_{1}$. Lille Molla (near Raftsund), $^{1}/_{4}$ 1899.

„ 10. *F. islandica* GRUN. The Skjerstad Fiord V, $^{2}/_{4}$ 1900, 0—400 m. A piece of a long chain after being ignited on cover-glass; $^{950}/_{1}$. Breadth 51 μ; 16—18 striæ on 10 μ. Connecting zone striate.

„ 11. *Thalassiothrix nitzschioides* GRUN. The Skjerstad Fiord V, $^{12}/_{4}$ 1900, 0—420 m.

a. A zigzag chain of 4 individuals, $^{450}/_{1}$.

b. 2 cells, one in side view, the other in valvar view, $^{950}/_{1}$. 52 μ long, 4 μ broad; 11 pearls on 10 μ. The undulations of the margin in the lower figure are due to an error in reproduction.

Fig. 12. *Nitzschia hybrida* Grun. b—e from Brettesnes, $^4/_4$ 1899. The striæ of the connecting zone are in reality much finer than in the figures.

a. The Skjerstad Fiord XII (outer part), $^4/_4$ 1900, 0—50 m.; $^{950}/_1$. 44 μ long, 8 μ broad; about 9 keel puncta on 10 μ. Transverse striæ (of the valve) were not visible.

b. *N. (hybrida var.?) pellucida* Grun.? One valve, in side view, $^{1475}/_1$. 38 μ long, about 10—11 keel puncta on 10 μ.

c, d. Cells in side view, c $^{660}/_1$, d $^{950}/_1$. In the figure d the keel puncta are a little too long. They were, however, somewhat, but only slightly, elongated.

e. 2 valves belonging to one cell, one of them in valvar view, showing a very excentric keel; $^{950}/_1$. The valve is, however, perhaps lying somewhat obliquely.

f. A twin cell of a different form, perhaps not belonging to *N. hybrida;* $^{950}/_1$. The Skjerstad Fiord XII, $^4/_4$ 1900, 0—50 m. 57 μ long, the breadth (of the cell) 7 μ; 12—14 keel puncta on 10 μ. About 27 striæ on 10 μ.

13. *N. lanceolata var. pygmæa* Cl. Valve (in valvar view), $^{950}/_1$. Lille Molla, $^{11}/_4$ 1899. 30 μ long, 4 μ broad. Keel puncta small, about 14 on 10 μ, in the middle of the valve wanting; there is a trace of a central nodule. Hardly belongs to *N. lanceolata* W. Sm.

14. *N. angularis var. kariana* Grun., $^{950}/_1$.

a. Cell in side view, from Seivaagen (Salten), $^5/_4$ 1900, 0—20 m. 54 μ long, 8 μ broad; 5—6 keel puncta on 10 μ, much closer at the ends, scarcely more distant in the middle. No transverse striæ were seen.

b. Valvar view. Lille Molla, $^1/_4$ 1899, 0 m. 36 μ long, 4 μ broad; $4^1/_2$ keel puncta on 10 μ. The longitudinal lines which accompany the keel, are badly reproduced.

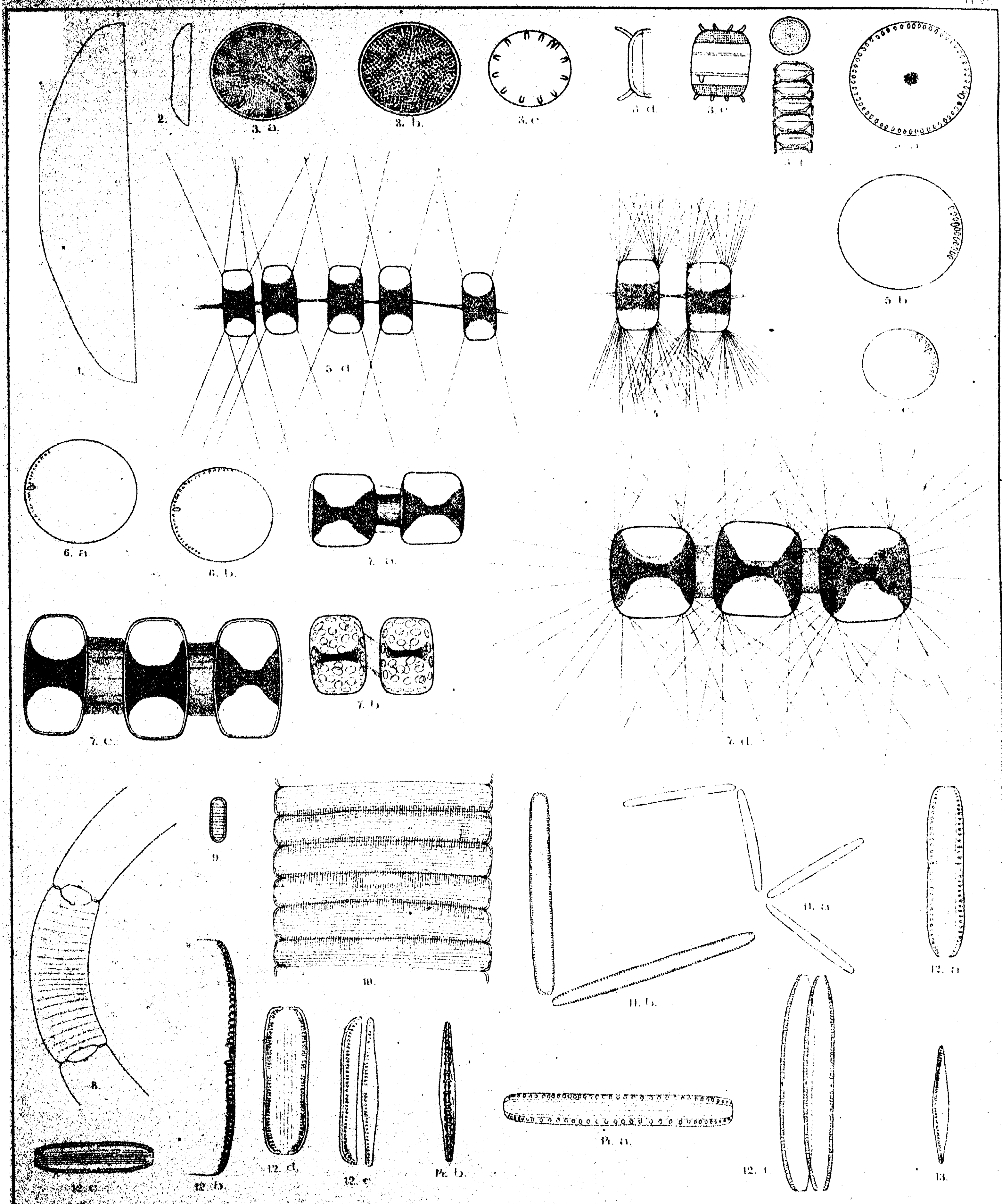

1.
2.
3. a.
3. b.
3. c.
3. d.
3. e.
5. d.
5. b.
6. a.
6. b.
7. a.
7. c.
7. b.
7. d.
9.
10.
11. a.
11. b.
12. a.
8.
12. d.
12. e.
12. b.
12. c.
13.

PLATE VII.

Fig. 15. *Nitzschia arctica* Cl.

a. Cell in side view, $^{950}/_1$. The Østnes Fiord I, $^{23}/_3$ 1900, 0—25 m. 80 μ long, 7 μ broad; 7—8 keel puncta on 10 μ. No distinct transverse striæ were seen. By an error in reproduction the margin appears to be a little undulated. The cell is, indeed, slightly broader in the middle, then evenly narrowed off to the ends, which are of even breadth.

The same species occurs in Cl. et Møll., nr. 318, from Cape Wankarema (slide in the Riksmusæum, Stockholm).

b. Cell in side view, $^{660}/_1$. Kvænangen, $^{21}/_4$ 1899, 300—200 m. 71 μ long, 8 μ broad; 8 keel puncta on 10 μ. The division lines of the connecting zone are here — as in the following figures — too plainly visible. They are in reality only seen with difficulty.

c. Cell in side view, $^{950}/_1$, from Brettesnes (Lofoten) $^4/_4$ 1899. The keel puncta of only one valve are illustrated. 61 μ long, 9 μ broad; about 10 keel puncta on 10 μ. Transverse striæ were not plainly visible. The connecting zone finely striate.

d. Cell in side view; $^{950}/_1$; a very large specimen. Følstad, $^4/_4$ 1899. 108 μ long, 12 μ broad; 9 and 10 keel puncta on 10 μ. On the left valve only the keel puncta of the median part are shown. The keel seemed to be very excentric. Transverse striæ indistinct.

e. A single valve, $^{950}/_1$. Lille Molla, $^1/_4$ 1899, 0 m. 96 μ long, 5 μ broad; $7^1/_2$ keel puncta on 10 μ. Striæ indistinct.

f. Valve in valvar view, $^{950}/_1$, from the same locality. 83 μ long, 4—$4^1/_2$ μ broad; 9 keel puncta on 10 μ. Striæ were not seen.

The specimens e—f are very similar to *N. lævissima* Grun., but seem to belong to the same species as a—d.

„ 16. *Tropidoneis parallela* Jørg. n. sp., $^{950}/_1$. a, b from 71° 48′ n., 49° 38′ e., S/S Heimdal, $^{31}/_5$ 1900.

a. Cell in side view. 70 μ long, 18 μ broad; about 16 striæ on 10 μ.

b. Valve (in valvar view). 67 μ × 12 μ, 15 striæ on 10 μ. Boatshaped, with a narrow, high, median part.

c. Twin cell, in side view. The Østnes Fiord I, $^{23}/_3$ 1900, 0—25 m. The striæ are only shown on a portion of the valve, and ought to be somewhat closer.

„ 17. *Pleurosigma tenerum* Jørg. = *P. Stuxbergii* Cl.

a—c. 3 cells with protoplasmatic parts, from samples conserved in formaline; $^{270}/_1$. Rombaken (the Ofoten Fiord) $^7/_2$ 1899, 0—40 m. Lengths 290 μ, 340, 275; breadths 38 μ, 38, 40. The inner parts are badly reproduced. In the figure a the chromatophores should not be united above. In b the chromatophore of the right side has partly disappeared. The median longitudinal line of the figure c is the raphe.

d. Cell in valvar view, $^{500}/_1$. The Salten Fiord II, $^5/_4$ 1900, 0—50 m. The specimen has been ignited on cover-glass and has become somewhat deformed.

„ 18. *P. delicatulum* W. Sm., $^{500}/_1$. Følstad, $^4/_4$ 1899, 0—3 m. 222 μ × 26 μ. The 3 crossing lines to the right show the direction of the striæ. Very similar to *P. delicatulum var. kariana* Grun., but differs in having the transverse striæ rather less close than the oblique ones.

„ 19. *P. tenuissimum* W. Sm. *var. hyperborea* Grun. The contour of the valve is badly reproduced.

a. Lille Molla, $^1/_4$ 1899, 0 m.; $^{950}/_1$. 77 μ × 5 μ; transverse striæ 20—22 on 10 μ, longitudinal ones 24.

b. Følstad, $^4/_4$ 1899, 0—3 m.; $^{660}/_1$.

„ 20. *P. tenuirostre* Grun., $^{950}/_1$. The Folden Fiord I, $^6/_4$ 1900, 0—100 m. The specimen lies somewhat obliquely. Only one half of the valve is given in the figure. In this position, close oblique striæ were seen, 25—30 on 10 μ. At the ends, indistinct longitudinal lines, which were somewhat wavy, were seen.

Fig. 21. *Navicula frigida* GRUN.

a. Cell in valvar view, showing the usual chromatophores; $^{450}/_{1}$. Senjenhavet, $^{13}/_{4}$ 1899, 0—80 m. (sample preserved in formaline).

b. Cell with chromatophores; larger form; $^{450}/_{1}$. Barent's Sea 71° 48′ n., 49° 38′ e. (S/S Heimdal $^{31}/_{5}$ 1900; c—e from the same locality).

c. 2 cells of a small form, one in valvar view, with chromatophores, the other in side view, $^{450}/_{1}$. Valve 34 μ × 11 μ.

d. Typical *N. frigida* GRUN., $^{950}/_{1}$. The transverse striæ are only slightly oblique towards the ends, not by far so much as in the figure. The longitudinal lines are only put on a small part of the valve. 55 μ × 14 μ.

e. A large specimen, somewhat deformed by being ignited on cover-glass; $^{950}/_{1}$. 96 μ × 15 μ; 12 transverse striæ on 10 μ; distinct longitudinal lines, much closer. No distinct central area.

f. A twisted chain, probably not belonging to *N. frigida*, $^{450}/_{1}$. The Skjerstad Fiord II, $^{2}/_{4}$ 1900, 0—180 m. On account of the chromatophores it seems related to *N. Vanhöffeni* and is perhaps *N. pelagica*.

„ 22. *N. Vanhöffeni* GRAN.

a. A chain with protoplasmatic contents; $^{450}/_{1}$. Senjenhavet, $^{13}/_{4}$ 1899, 0—80 m.

b. 2 cells of a chain, in the process of selv-dividing; $^{450}/_{1}$. Barents Sea 71° 48′ n., 49° 38′ e., $^{31}/_{5}$ 1900 (f, g from the same locality).

c, d. Chains, after being ignited on cover-glass, $^{450}/_{1}$. The central nodules smaller and more indistinct than in the figure d; in c they have disappeared. The cell walls, also in c, should be much narrower. Malangen, $^{14}/_{4}$ 1899, 0—3 m.

e. Chain, ignited; $^{660}/_{1}$. Brettesnes, $^{14}/_{4}$ 1899. The central nodules smaller than in the figure; the division lines of the connecting zone very fine.

f. 2 valves with intermediate complex connecting zone, somewhat deformed (a short time treated with sulphuric and nitric acids, then ignited on cover-glass); $^{950}/_{1}$. Length 38 μ, breadth 6 μ (or a little more). In the middle something like a narrow transverse stauros was indistinctly seen. It might, however, also be due to indistinct striæ (the striæ otherwise being quite invisible).

g. Like f. The valve boatshaped, somewhat higher in the middle than at the ends. Length 24 μ, breadth 6 μ. On one valve the stauroslike figure in the middle is shown.

h. A narrow valve; $^{950}/_{1}$. Følstad, $^{4}/_{4}$ 1899, 0—3 m.

i. Cell in optical transverse section, with chromatophore. Barent's Sea, $^{31}/_{5}$ 1900.

„ 23. *N. pelagica* CL. A chain, after being ignited on cover-glass; $^{660}/_{1}$. Length of the cells 17 μ. Brettesnes, $^{4}/_{4}$ 1899.

„ 24. *Stauroneis septentrionalis* GRUN. Barent's Sea $^{31}/_{5}$ 1900 (cfr. above).

a. Valve; $^{950}/_{1}$. To the left the striæ in the middle part of the valve are represented.

b—g. Different valves; $^{950}/_{1}$. On several of them the striæ of the middle part are shown. Those towards the ends were only seen with difficulty.

h. A chain with protoplasmatic contents; $^{450}/_{1}$.

i. Another chain. In 3 of the cells the protoplasmatic contents are seen.

k. A chain, after being ignited on coverglass; $^{950}/_{1}$. The striæ towards the ends are not seen distinctly. On most of the cells only the more conspicuous median striæ are illustrated. All striæ much finer than in the figure.

„ 25. *S. Grani* JØRG. n. sp. Barent's Sea, $^{31}/_{5}$ 1900.

a. A chain with protoplasmatic contents; $^{450}/_{1}$. (Sample not well preserved).

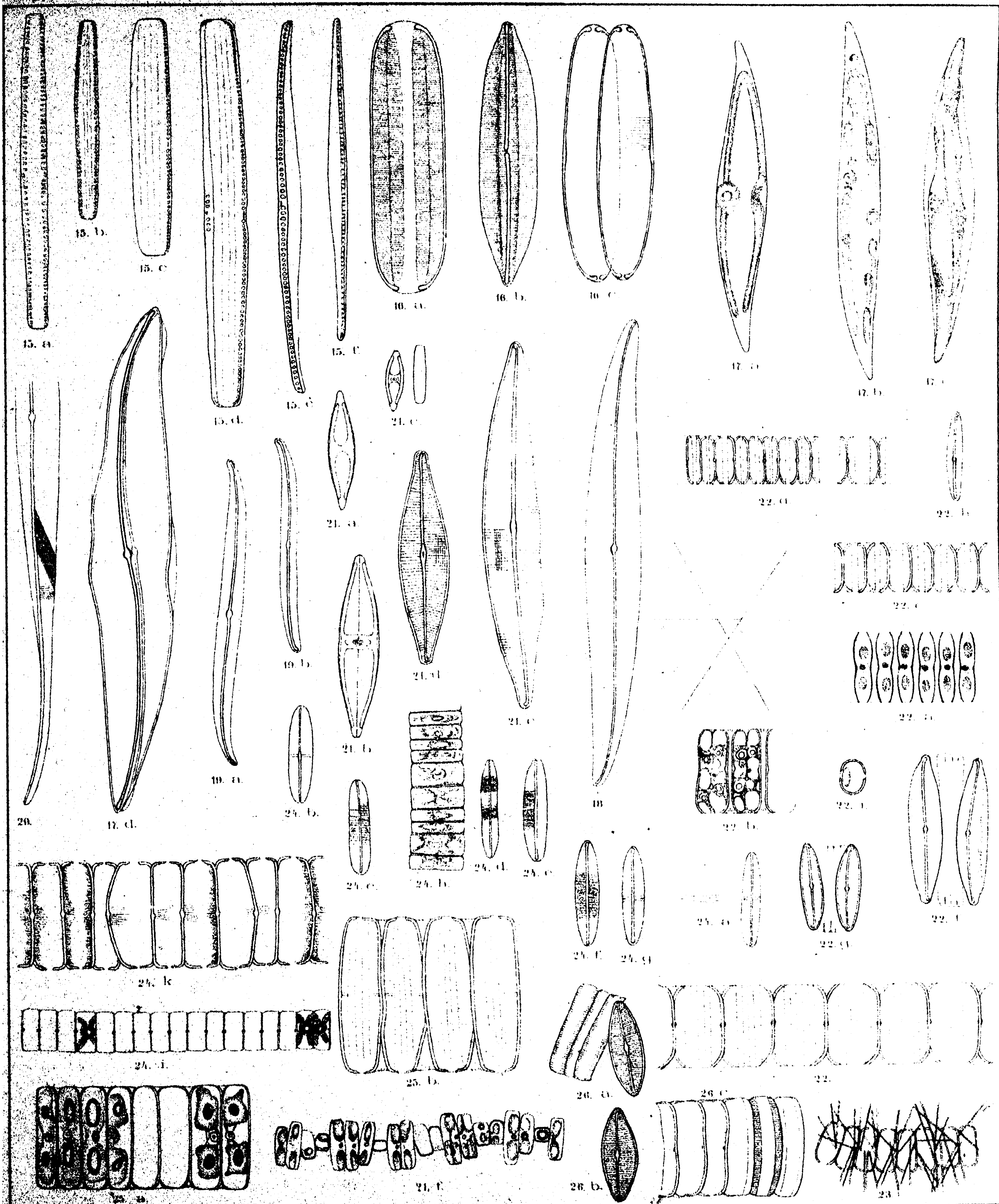
b. A chain, after being ignited on cover-glass; $^{950}/_{1}$. Between the cells, a connecting zone with very fine division lines is seen.

„ 26. *Achnanthes sp.*, $^{450}/_{1}$. The Salten Fiord II, $^{5}/_{4}$ 1900, 0—50 m.

a. Lower valve with 3 cells of a chain, ignited. The structure of the valve is badly reproduced. The striation should be more regular, and only slightly radiate towards the ends.

b. Like a. The upper end nodule should not be distant from the end. The valve lies somewhat obliquely.

c. A chain ignited. Only the striæ of one valve is seen in the figure. The 3 left cells are represented in optical section.



F. Wyssmann & H. Fischer del.

PLATE VIII.

PLATE VIII.

Fig. 27. *Achnanthes tæniata* GRUN.; $^{950}/_{1}$. Sea of Kara, bottom mud from a depth of 36 fathoms (Swedish Expedition to Jenissey 1875; sample from the Riksmusæum, Stockholm).

a. Part of a long chain, ignited on cover-glass (dry preparation). Breadth 24 μ.

b. Part of another chain, in styrax. Here it is more distinctly seen that only one valve is provided with a central nodule.

„ 28. *A. hyperborea* GRUN. Barent's Sea, $^{31}/_{5}$ 1900.

a. Lower valve; $^{950}/_{1}$. In the middle part more distant and conspicuous striæ, the others, towards the ends, rather indistinct. Dry preparation. The valve appeared distinctly convex. Length 28 μ.

b. Lower valve, from the inner side; $^{950}/_{1}$. 28 μ × 6 μ.

c. Part of a chain of the same species (?), ignited on cover-glass; $^{660}/_{1}$. Length of the valve 30 μ.

„ 29. *Peridinium pedunculatum* SCHÜTT, $^{450}/_{1}$. The Oster Fiord near Bergen, 1901.

a and d. Ventral view.

b and c. The same specimen, dorsal view.

e. The same, seen from the right side.

„ 30. *Hexacontium enthacanthum* JØRG., $^{450}/_{1}$. Sea northwest of Vesteraalen, $^{23}/_{2}$ 1901, 0 m. (S/S Michael Sars).

a. Second shell with two radial spines and a portion of the outer shell. Only 2 byspines are figured.

b. The inmost shell.

„ 31. *H. pachydermum* JØRG., $^{450}/_{1}$.

a. The Herlø Fiord (near Bergen), $^{12}/_{8}$ 1898. Only some of the byspines of the outer shell are figured.

b. Henningsvær, $^{6}/_{3}$ 1899.

„ 32. *Hexacontium*; young specimen, as yet with only two shells; $^{450}/_{1}$. From the same locality as fig. 30.

a. Second shell with 4, as yet only thin, radial spines.

b. The same specimen in optical section, showing the two shells.

„ 33. *Echinomma leptodermum* JØRG., $^{450}/_{1}$.

a. Kvænangen I, $^{24}/_{1}$ 1899, 0—140 m.

b. Sea off Røst, $^{22}/_{3}$ 1899. The outer shell is partly removed.

c. Helligvær, $^{12}/_{1}$ 1899, 0—250 m., without outer shell. The 3rd shell is indicated by transverse processus on the radial spines.

„ 34. *Drymyomma elegans* JØRG., $^{450}/_{1}$. Skroven, $^{4}/_{2}$ 1899, 0—300 m.

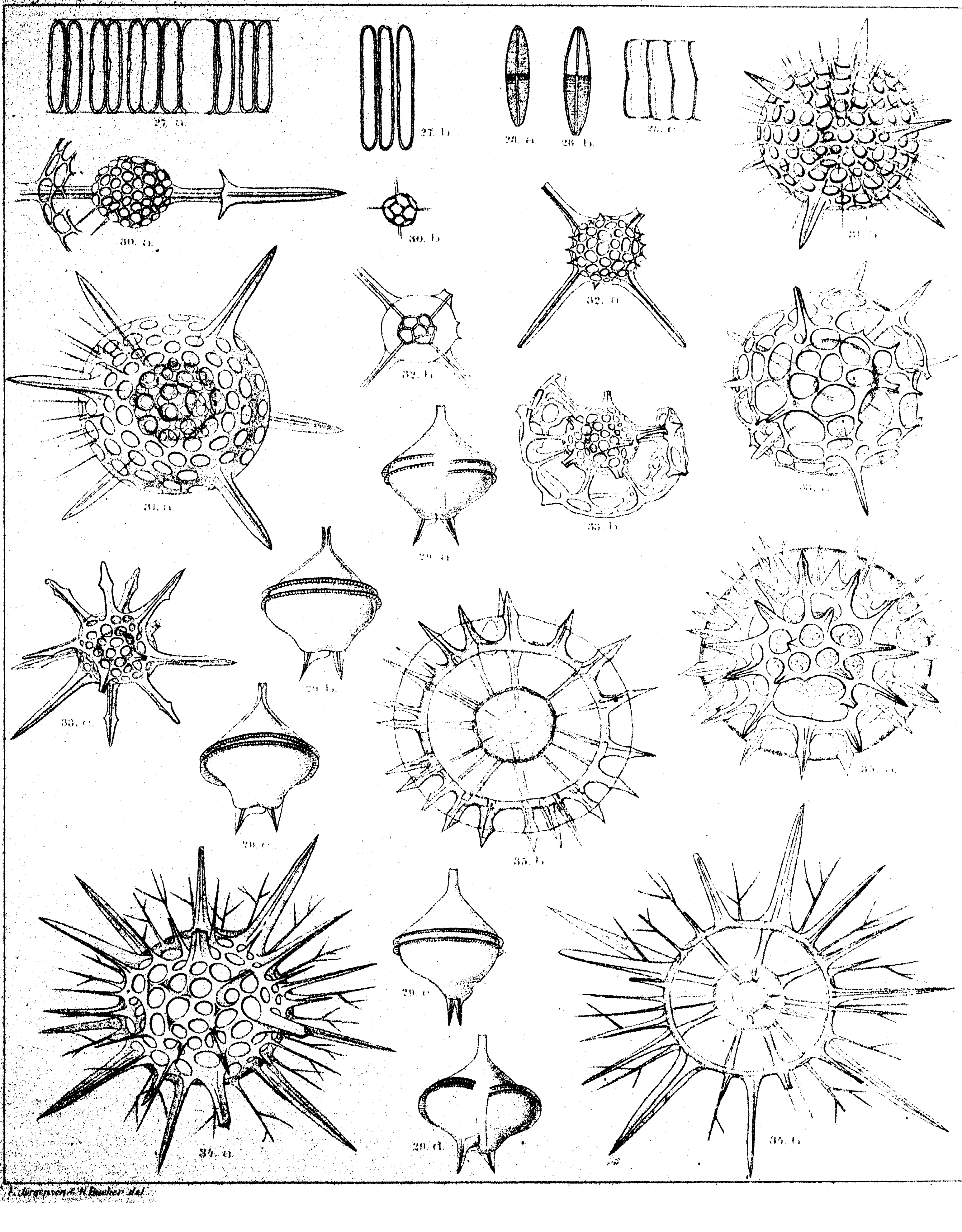
a. Outer shell with main- and byspines.

b. The same specimen in optical section, showing the 3 shells.

„ 35. *Chromyechinus borealis* (CL.), $^{450}/_{1}$. The Tys Fiord, $^{28}/_{3}$ 1899, 0—700 m.

a. The 3rd shell with main- and byspines. Around it the very delicate outer shell is seen (only incompletely illustrated). Also the shell next to the inmost one is indicated in the figure; it is more distinctly seen through a large (accidental) irregular hole in the 3rd shell.

b. The same specimen. Optical section, showing the 4 shells.



E. Jørgensen & H. Bucher del.

PLATE IX.

PLATE IX.

Fig. 36. *Chromyechinus borealis* (Cl.), $^{450}/_{1}$. The outer shell is only indicated by the transverse processus of the radial spines. Larger spines on one side of the shell. Kvænangen, $^{24}/_{1}$ 1899.

a. The 3rd shell, with spines.

b. Optical section, showing the three shells. Diameters 93 μ, 40 μ,? Pores very uneven, 10—25 μ, ± 6 μ,?

„ 37. *C. borealis* (Cl.), the larger form with byspines on the 4th shell; $^{450}/_{1}$.

a. Sea off Røst, $^{22}/_{3}$ 1899, 0—900 m. Optical section, showing the 4 shells. Diameters 132 μ, 89, 38, $\geq$ 17.

b. The same specimen. A portion of the 3rd shell with one larger and two smaller radial spines and pores, together with a portion of the 4th shell, with pores.

c. A form with well developed byspines on the 4th shell; optical section. The Vest Fiord, $^{1}/_{2}$ 1899, 0—200 m.

d. The same specimen. The portion of the 3rd shell, where the outmost shell is wanting; pores and spines.

e. The same. A portion of the 4th shell (very thinwalled) with pores, main spines and byspines (slender, oblique).

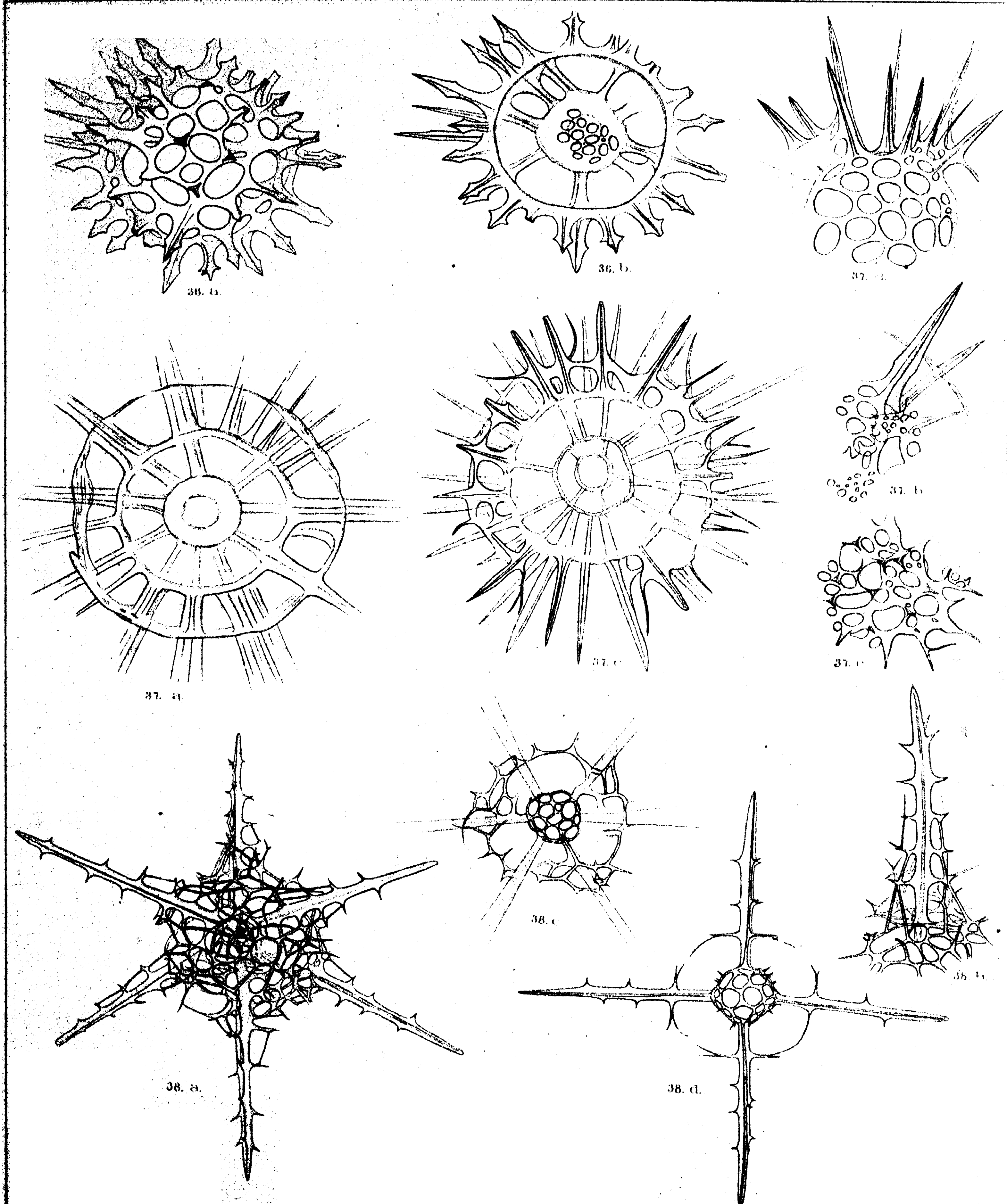
„ 38. *Rhizoplegma boreale* (Cl.) Jørg., $^{450}/_{1}$.

a. A well developed specimen. Sea off Røst, $^{22}/_{3}$ 1899, 0—900 m.

b. The same specimen. One of the main spines with surrounding network.

c. The same. The inner shell; the other parts in optical section.

d. Young specimen. From the sea between Norway and Iceland, due east of Iceland, 65° 43′ n., 3° 1′ w., $^{14}/_{12}$ 1903 (S/S Michael Sars).



[illegible] del.

PLATE X.

PLATE X.

Fig. 38. *Rhizoplegma boreale* (CL.) JØRG., $^{450}/_1$.

e. Young specimen with 7 main spines. Diameter of the inner shell 28—30 μ. Sea 40 miles NW of Gaukværø, $^{19}/_1$ 1899, 0—700 m.

f. Young specimen, divergent form with 11 main spines. Henningsvær, $^{17}/_1$ 1899, 0—180 m.

„ 39. *Stylodictya tenuispina* JØRG. n. sp., $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m.

a. In the figure the inner rings are seen, and the connecting inner radial beams which are, however, only shown on the space between the two outer rings. The coarse pores on the median part of the shell and some of the pores on the other portion are also depicted.

b. The same specimen, optical section, showing the rings and radial beams.

c. The same in side view, optical section. In the middle the rounded higher portion is seen. Punctiform byspines on both sides.

„ 40. *S. validispina* JØRG. n. sp., $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m.

a. Optical section, showing the system of rings and the radial spines. The pores on the outside are shown on a portion of the valve.

b. The same specimen in side view; optical section.

„ 41. *S. aculeata* JØRG. n. sp., $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m.

a. The disc from above, with pores and radial spines. The small dark puncta on the surface are the byspines. The inner rings are suggested.

b. The same specimen; optical section.

c. The same in side view; optical section.

„ 42. *Phorticium pylonium* (HCK.?) CL., $^{450}/_1$. The Tys Fiord, $^{28}/_3$ 1899, 0—700 m.

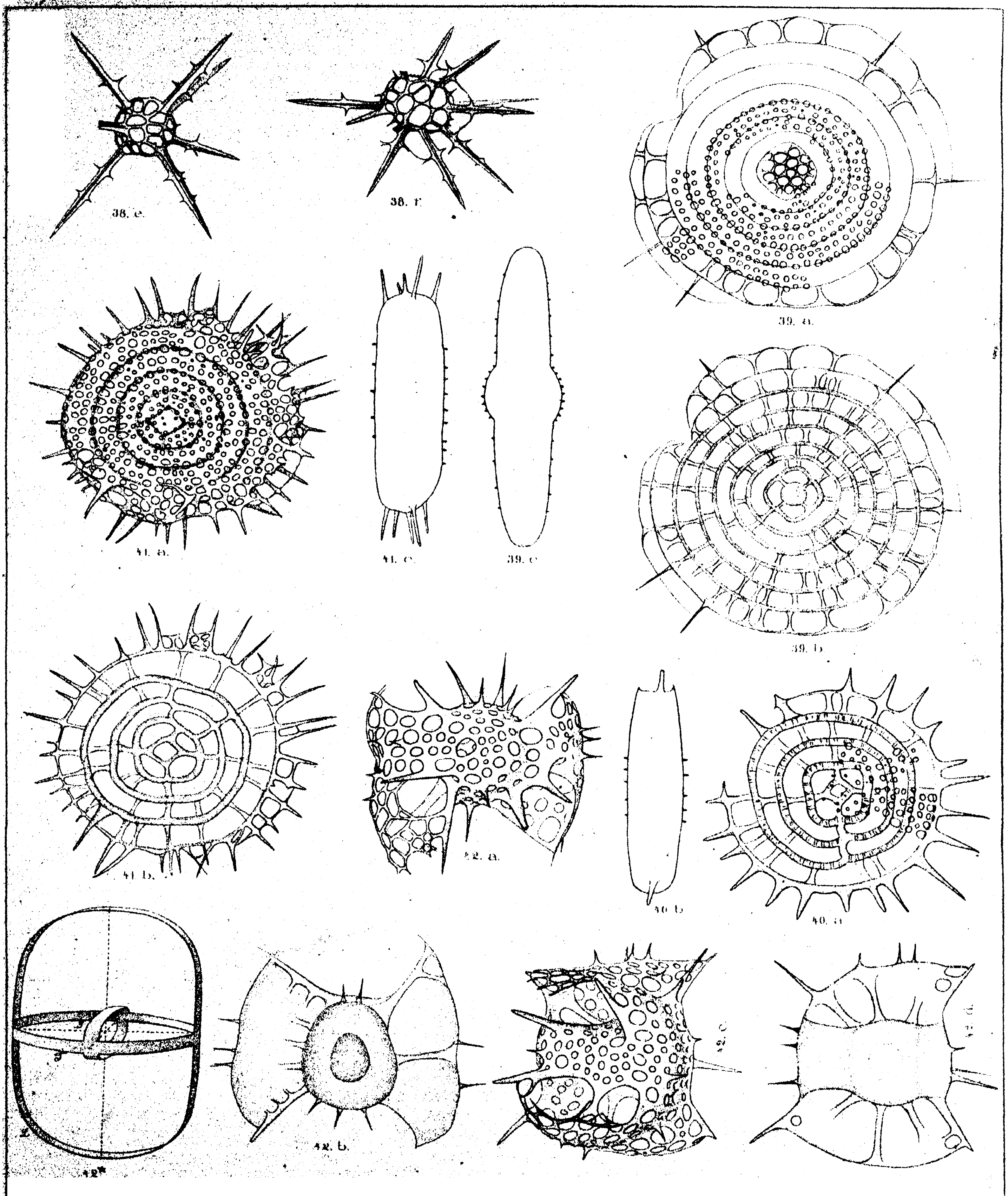
*. Schematical figure, dorsal view, showing in perspective the 3 girdles, perpendicular to each other. The figure shows only one of these systems of girdles; in reality there are 3 of them. L = the lateral girdle, seen from the (narrow) side; T = the transverse girdle, S = the sagittal one. In the middle of the latter an inner lateral girdle is developed, parallel to the outer one (is not seen in the figure), in the middle of this inner lateral girdle, an inner transverse one, a. s. o. For the sake of clearness, the girdles are depicted narrow, and distinctly compressed.

a. Dorsal view, showing the pores and the outer spines (main- and byspines).

b. The same specimen, same view, optical section (lateral section). To the right and left the outer lateral girdle is seen, and parallel to this two inner ones.

c. Same specimen, apical view. When the figure is seen from the side, where the number (42 c) is printed, it answers to the fig. a, seen from above.

d. Same specimen, same view; optical section (= transverse one). The transverse girdle goes around the figure, and is seen from the (narrow) side. Across this girdle the outer sagittal one is seen, and in the inner, the second and third transverse ones.



E. Jørgensen del.

PLATE XI.

PLATE XI.

Fig. 42. *Phorticium pylonium* (HCK.?) CL., $^{450}/_{1}$. The Tys Fiord, $^{28}/_{3}$ 1899, 0—700 m.

c. The same specimen as fig. 42 a—d (pl. X); lateral view.

f. Same specimen, same view, optical section (= sagittal one). The outer sagittal girdle is seen from the side, and two similar inner ones.

„ 43. *Ph. pylonium* (HCK.?) CL., *forma (?)*; $^{450}/_{1}$. From the same locality. In a certain position of the shell, this spiral is seen.

„ 44. *Ph. pylonium* (HCK.?) CL., *forma (?)*; $^{450}/_{1}$. *Octopyle octostyle f. minor* JØRG. Sea off Røst, $^{22}/_{3}$ 1899, 0—900 m. Apical view.

„ 45. *Ph. pylonium* (HCK.?) CL., *forma (?)*; $^{450}/_{1}$. *Octopyle octostyle f. minor* JØRG. From the same locality.

a. Dorsal view.

b, d. The same specimen; lateral view. The right and left sides correspond to the lower and upper ends of fig. a.

c. Same specimen; apical view.

„ 46. *Streblacantha circumtexta* (JØRG.), $^{450}/_{1}$. The Tys Fiord, $^{28}/_{3}$ 1899, 0—700 m.

a. There are more byspines than illustrated in the figure. Most of them are only seen with difficulty, except near the outlines.

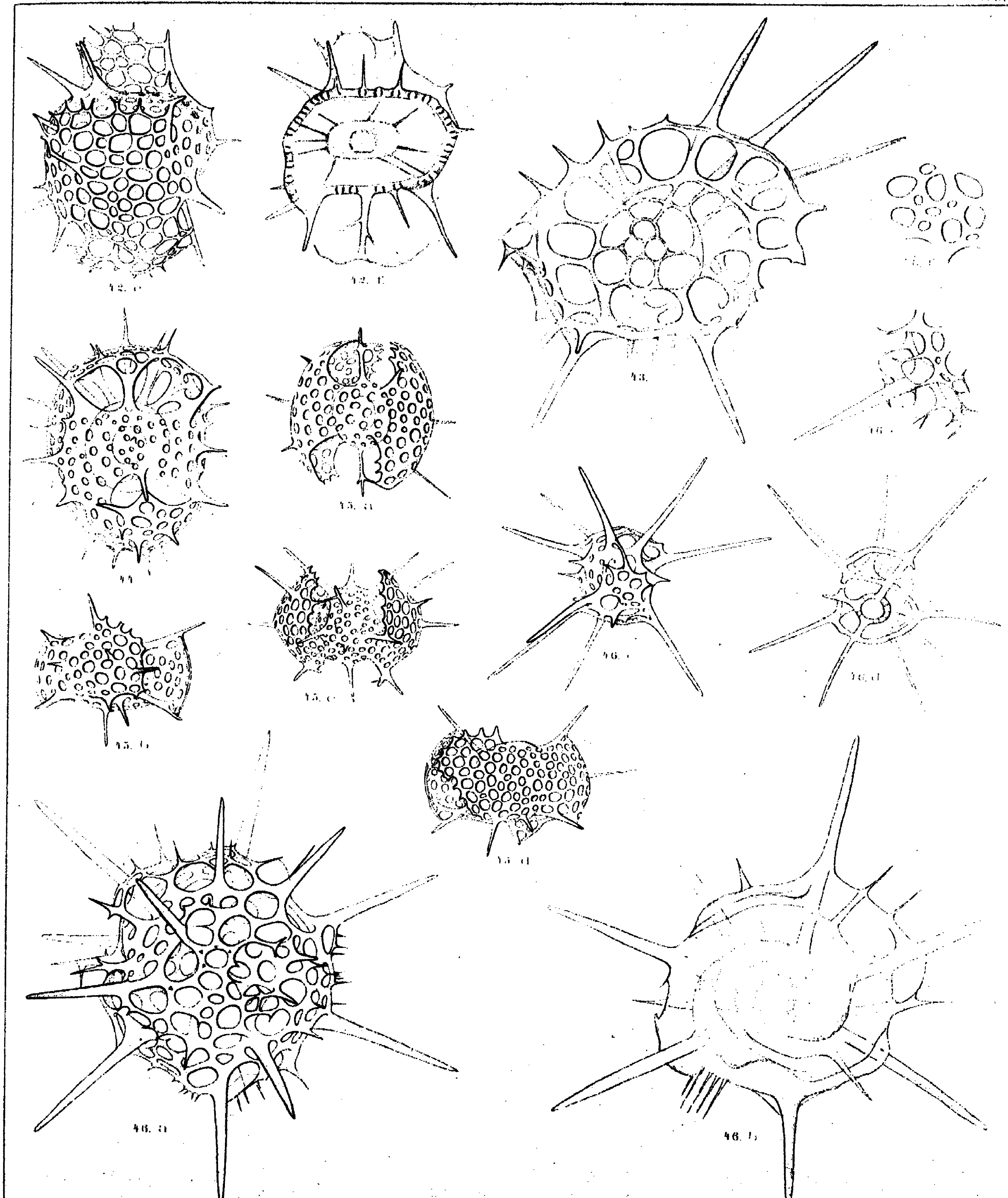
b. Same specimen, same view, optical section.

c. Young specimen with 9 main spines.

d. The same in optical section.

f. The pores on a portion of the outer shell, of an older specimen.

e. Same specimen, showing a piercing main spine with the fine connecting beams between the byspines. Side view.



E. Jørgensen del

PLATE XII.

PLATE XII.

Fig. 46. *Streblacantha circumtexta* (Jørg.).

g. The same specimen as fig. 46 a (pl. XI), in another position; optical section, $^{450}/_{1}$.

h. $^{400}/_{1}$. From the same locality.

i. The same, in optical section.

l. Young specimen, $^{450}/_{1}$. The Vest Fiord I, $^{13}/_{1}$ 1899, 0—180 m.

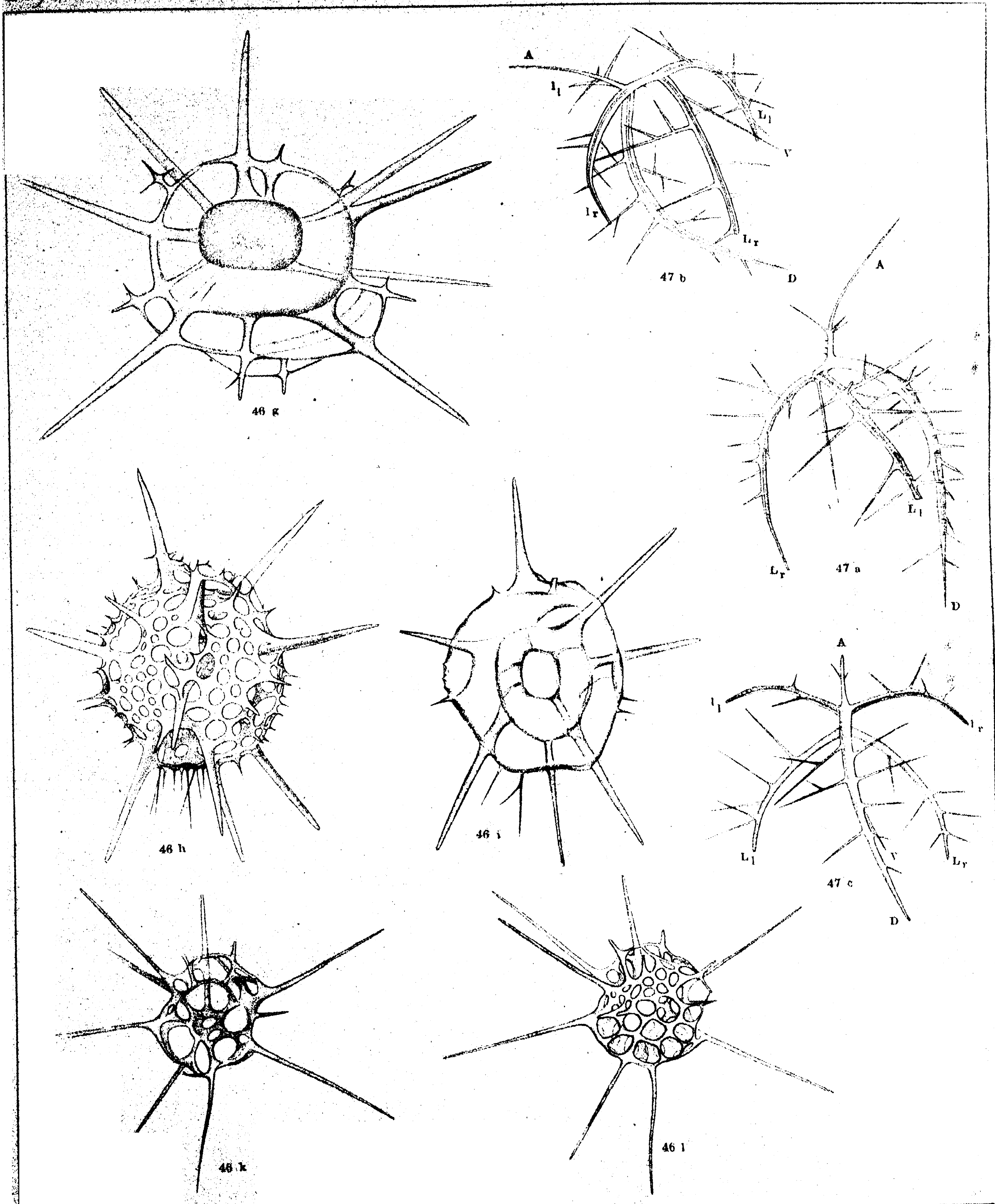
k. The same, in optical section.

„ 47. *Campylacantha cladophora* Jørg. n. sp., $^{450}/_{1}$. The Tys Fiord I, $^{28}/_{1}$ 1899, 0—700 m. In this figure, and in the following of species of the group *Nassellaria,* the letters have the same signification as in the corresponding description given on pp. 122—140: A is the apical main spine, D the dorsal one, L_r the right lateral, L_l the left lateral main spine, V the ventral sagittal spine.

a. Oblique lateral view. The secondary lateral spines are not seen.

b. Oblique view, where one of these secondary lateral spines is distinctly seen.

c. Dorsal view, showing both these secondary spines.



E. Jørgensen del.

PLATE XIII.

PLATE XIII.

Fig. 48. *Dictyocircus clathratus* JØRG. n. sp. Henningsvær, $^{20}/_3$ 1899. a $^{500}/_1$, b—e $^{400}/_1$. As regards the signification of the letters, cfr. above p. 125 and p. 130.

a. Dorsal view.

b. Dorsal-lateral view.

c. Sagittal view. Only the meshes f, the spines g and the right side of the spines k and meshes c are illustrated.

d. Lateral view.

e. Ventral view.

„ 49. *Ceratospyris hyperborea* JØRG. n. sp., $^{450}/_1$. The Vest Fiord $^1/_3$ 1899, 0—200 m.

„ 50. *Plectacantha oikiskos* JØRG., $^{450}/_1$. Ofoten II, $^7/_3$ 1899, 0—100 m. Apical view. Diameter of the network about 65 μ.

„ 51. *P. oikiskos* JØRG., *var.*; $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m. Very strong spines and arches.

a. Ventral view; the primary ventral arch and the primary ventral mesh in front.

b. The same specimen, apical view. Length of spine D 55 μ; greatest breadth of the beams 6 μ; largest mesh (the secondary mesh to the right of spine D) 22 × 15 μ.

c. The same, lateral view; the left lateral arch and the left lateral mesh in front.

d. The same, lateral view; the right lateral arch and the right lateral mesh in front.

e. The same as the foregoing, but turned 90° upwards. The mesh beyond (and below) the right lateral mesh in front.

„ 52. *P. oikiskos* JØRG., $^{380}/_1$. The Vest Fiord I, $^{18}/_1$ 1899, 0—180 m. Young specimen. Antapical view.

„ 53. *P oikiskos* JØRG., $^{400}/_1$. Henningsvær, $^{20}/_3$ 1899, 0—280 m. Lateral view; the right lateral arch and mesh in front.

„ 54. The same, $^{450}/_1$. Dorsal view.

„ 55. *P. oikiskos* JØRG., $^{380}/_1$. Helligvær, $^{17}/_1$ 1899, 0—250 m.

a. Lateral view; the right lateral arch in front.

b. The same, turned a little upwards and to the left.

c. Lateral view; the right lateral main spine in front. The unclosed network is seen.

d. Lateral view; the meshes under the right lateral spine in front.

e. Antapical view.

„ 56. *P. oikiskos* JØRG., $^{450}/_1$.

a. Somewhat oblique antapical view. The Vest Fiord II, 0—200 m., $^{13}/_1$ 1899. Diameter of the network about 50 μ.

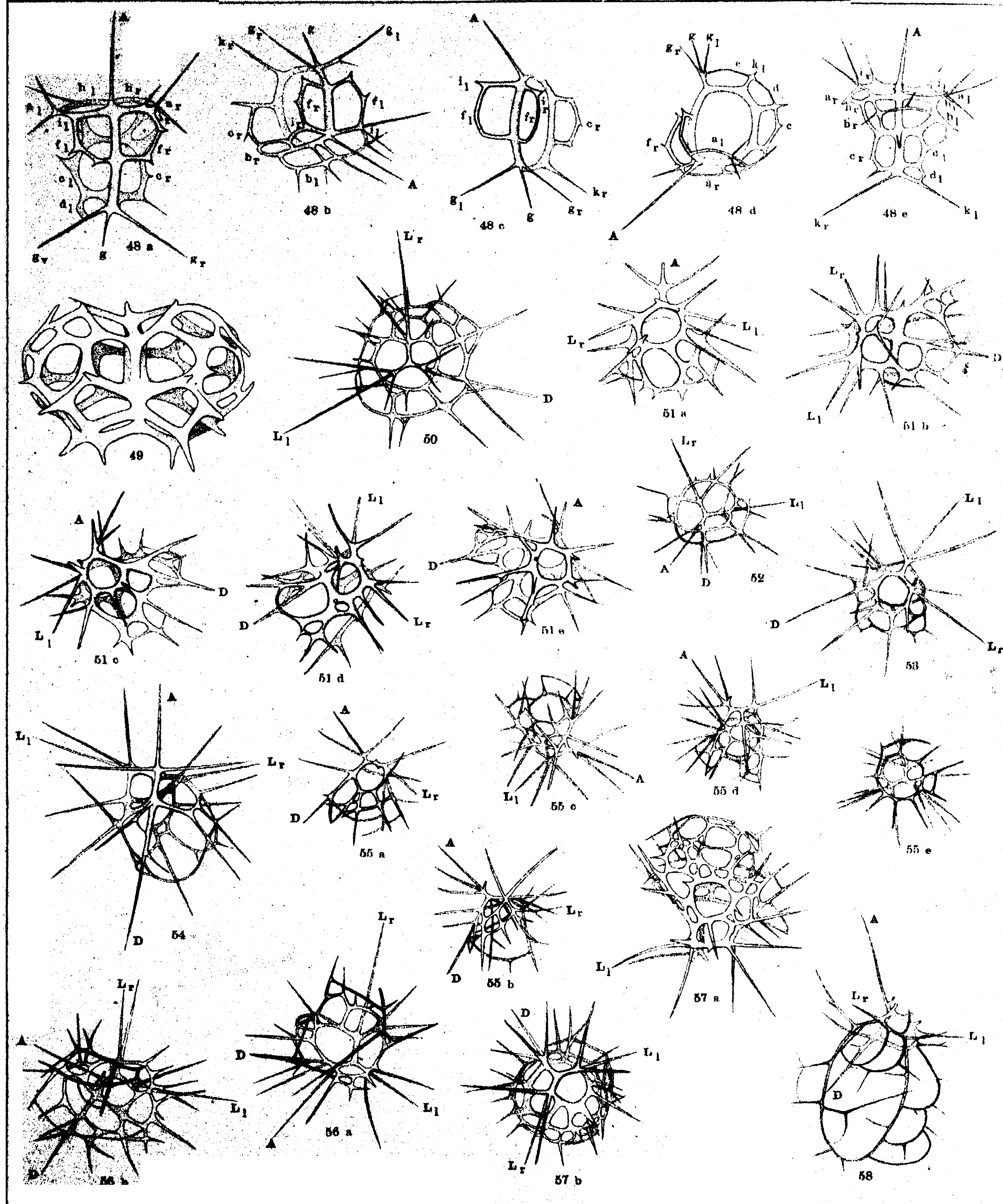
b. Oblique antapical view. Sea off Aalesund, 61° 56′ n., 2° 40′ e., $^{10}/_3$ 1893, 0 m. (S/S Michael Sars). Diameter of the network about 60 μ.

„ 57. *P. oikiskos* JØRG., $^{380}/_1$. A well developed specimen from Henningsvær, $^{20}/_3$ 1899, 0—280 m.

a. Ventral view; the ventral arch and the network above, in front.

b. The same, apical view.

„ 58. *P. trichoides* JØRG. n. sp., $^{450}/_1$. Ventral-lateral view; the right lateral spine in front. Sea north of Shetland, 63° 36′ n., 0° 32′ e., $^{11}/_3$ 1903 (S/S Michael Sars).



E. Jørgensen del.

PLATE XIV.

PLATE XIV.

Fig. 59. *Phormacantha hystrix* (JØRG.) JØRG., $^{600}/_1$. The Vest Fiord I, $^{13}/_1$ 1899, 0—180 m. A well developed specimen.

a. Lateral view; placed as a species of *Monocyrtida* after HÆCKEL, with the „tophorn" upwards. The right lateral main spine, L_l, in front.

b. The same, dorsal view, showing the network round the (columella and) tophorn. The spine A is removed.

c. The same, ventral view, showing the ventral sagittal spine and the network above. The other main spines are only indicated.

„ 60. *Ph. hystrix* (JØRG.) JØRG., $^{450}/_1$. Ofoten II, $^{7}/_2$ 1899, 0—100 m. Lateral view, the right lateral arch (B_l) and mesh in front. A young specimen, perhaps belonging to a species intermediate between *Phormacantha hystrix* and *Plectacantha oikiskos*. Diameter of the network about 68 μ. Skeleton very light in weight.

„ 61. *Ph. hystrix* (JØRG.) JØRG., $^{380}/_1$. Helligvær, $^{12}/_1$ 1899, 0—250 m. A young specimen; dorsal view. Length of the spine L_r 75 μ.

„ 62. *Ph. hystrix* (JØRG.) JØRG., $^{450}/_1$. Sea off Aalesund, 61° 56′ n., 2° 40′ e., $^{10}/_2$ 1903 (S/S Michael Sars). A young specimen; ventral view. The short branch from spine L_l to the point of connection between the ventral (B_v) and the one lateral arch (B_l) is distinctly seen.

„ 63. *Ph. hystrix* (JØRG.) JØRG., $^{450}/_1$. From the same locality. Lateral view. The short common branch, mentioned under fig. 62, is here in front, together with the right lateral arch (B_l) and the network above. The spine A is broken off.

„ 64. *Gonosphæra primordialis* JØRG. n. sp., $^{380}/_1$. The Oster Fiord (near Bergen), $^{13}/_8$ 1900, 200—400 m. Diameter of the ring 22 μ; length of the largest spine about 100 μ.

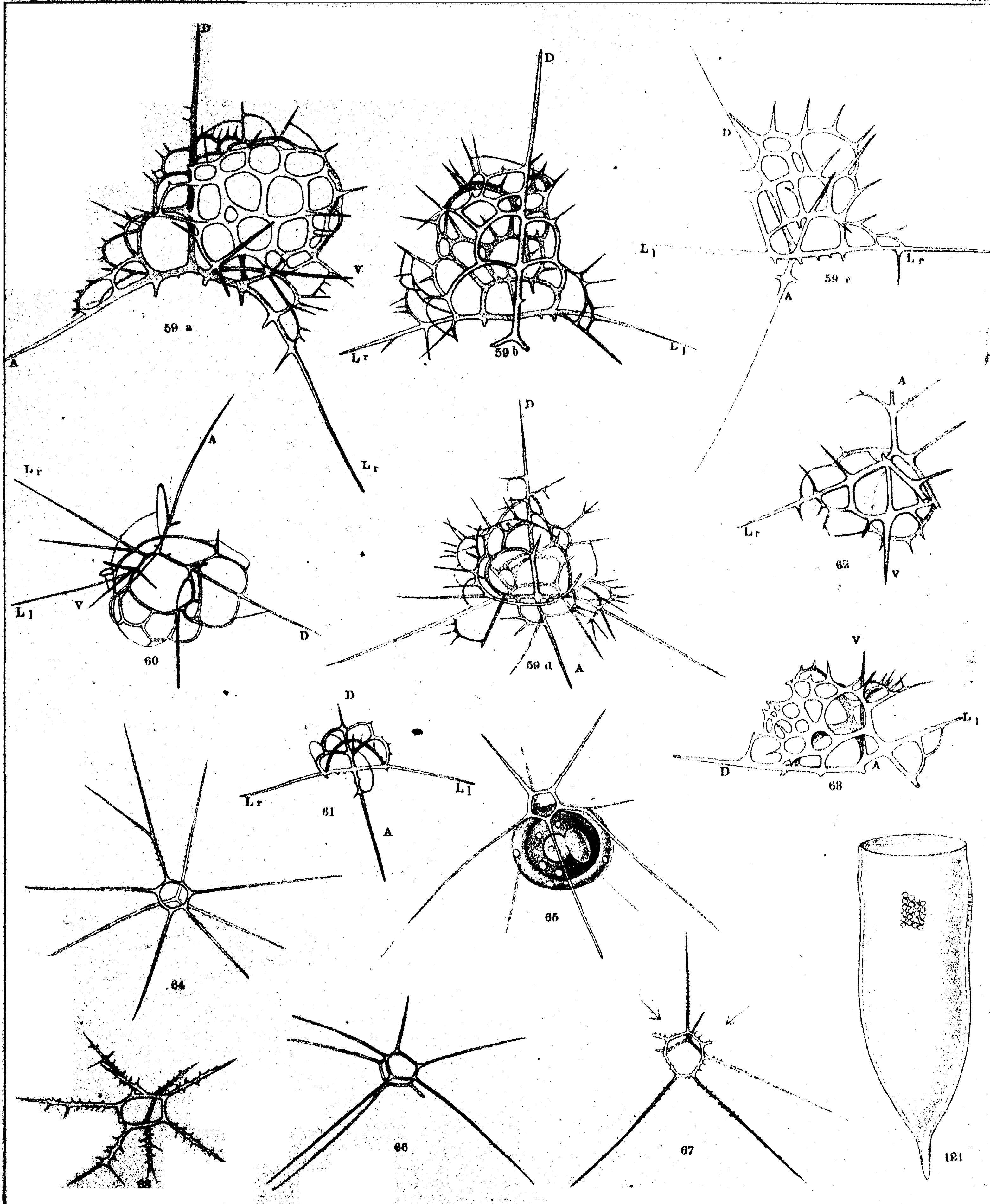
„ 65. *G. primordialis* JØRG., $^{380}/_1$. Ofoten II, $^{7}/_2$ 1899, 0—250 m. From a sample preserved in formaline.

„ 66. *G. primordialis*, JØRG., $^{450}/_1$. Skroven, $^{4}/_2$ 1899, 0—350 m. The connecting polygonal beam, with its two long, spreading spines, is seen below and to the left. Diameter of the ring 17 μ, length of the largest spine 90 μ.

„ 67. *G. primordialis* JØRG., $^{450}/_1$. From the same locality. The two pentagons are seen above, to the right and to the left (the arrows are perpendicular to their planes), the connecting polygonal beam below.

„ 68. *G. primordialis* JØRG., *var.*, $^{450}/_1$. Sea between Norway and Iceland, due east of Iceland, 65° 43′ n., 3° 1′ w., $^{14}/_2$ 1903, 100—0 m. (S/S Michael Sars). Diameter of the pentagons 22 μ; largest spines 50 μ long. Perhaps a different species.

„ 121. House of *Cyttarocylis denticulata* (EHRB.) FOL., *var. subedentata* JØRG. n. var.; $^{450}/_1$. The Øx Fiord, $^{14}/_2$ 1899, 0—90 m. Length 145 μ, breadth 51 μ; narrow end („tail tip") 17 μ long. Teeth 36—38. The areoles are only figured on a little portion of the surface and the wall.



E. Jørgensen del.

PLATE XV.

PLATE XV.

Fig. 69. *Protoscenium simplex* (Cl.) Jørg., $^{660}/_{1}$. Sea north of Shetland 63° 36′ n., 0° 32′ e., $^{11}/_{3}$ 1903, 0 m. (S/S Michael Sars). Somewhat oblique, apical view. Diameter of the network 68 μ.

„ 70. *Euscenium corynephorum* Jørg., $^{450}/_{1}$. Raftsund, $^{3}/_{3}$ 1899, 0—260 m. Oblique antapical view. Diameter of the network about 100 μ; longest spines 120 μ.

„ 71. *Cladoscenium tricolpium* (Hck.) Jørg., $^{450}/_{1}$. A well developed specimen from the By Fiord (near Bergen), $^{21}/_{3}$ 1899, 0—50 m. Ventral-lateral view; the spine L_l in front. Network 58 μ high, 75 μ broad. Tophorn protruding 94 μ.

b. The same as a, optical section, showing the most important spines and arches.

„ 72. *C. tricolpium* (Hck.) Jørg., very young specimen; $^{380}/_{1}$. Helligvær, $^{12}/_{1}$ 1899, 0—250 m.

a. Oblique, apical view.

b. Lateral view; the spine L_l in front.

„ 73. *C. tricolpium* (Hck.) Jørg., young specimen; $^{380}/_{1}$. Fom the same locality. Apical view.

„ 74. *C. limbatum* Jørg. n. sp., $^{450}/_{1}$. Sea 40 miles NW of Gaukværø, $^{19}/_{1}$ 1899, 0—700 m. Lateral view. In the upper part, the outer network is removed.

„ 75. *Peridium longispinum* Jørg. Sea off Aalesund, 61° 56′ n., 2° 40′ e., $^{10}/_{3}$ 1903, 0 m. (S/S Michael Sars). A well developed specimen.

a. Ventral view; the „tophorn" downwards; $^{660}/_{1}$.

b. The same, lateral-ventral view; the spine L_r in front; $^{450}/_{1}$. Diameter of the network 32 μ.

„ 76. *P. longispinum* Jørg., $^{450}/_{1}$. The Vest Fiord II, $^{18}/_{1}$ 1899, 0—200 m. The typical form. Cephalis 42 μ high.

a. Lateral-ventral view.

b. Lateral view; the spine L_r in front.

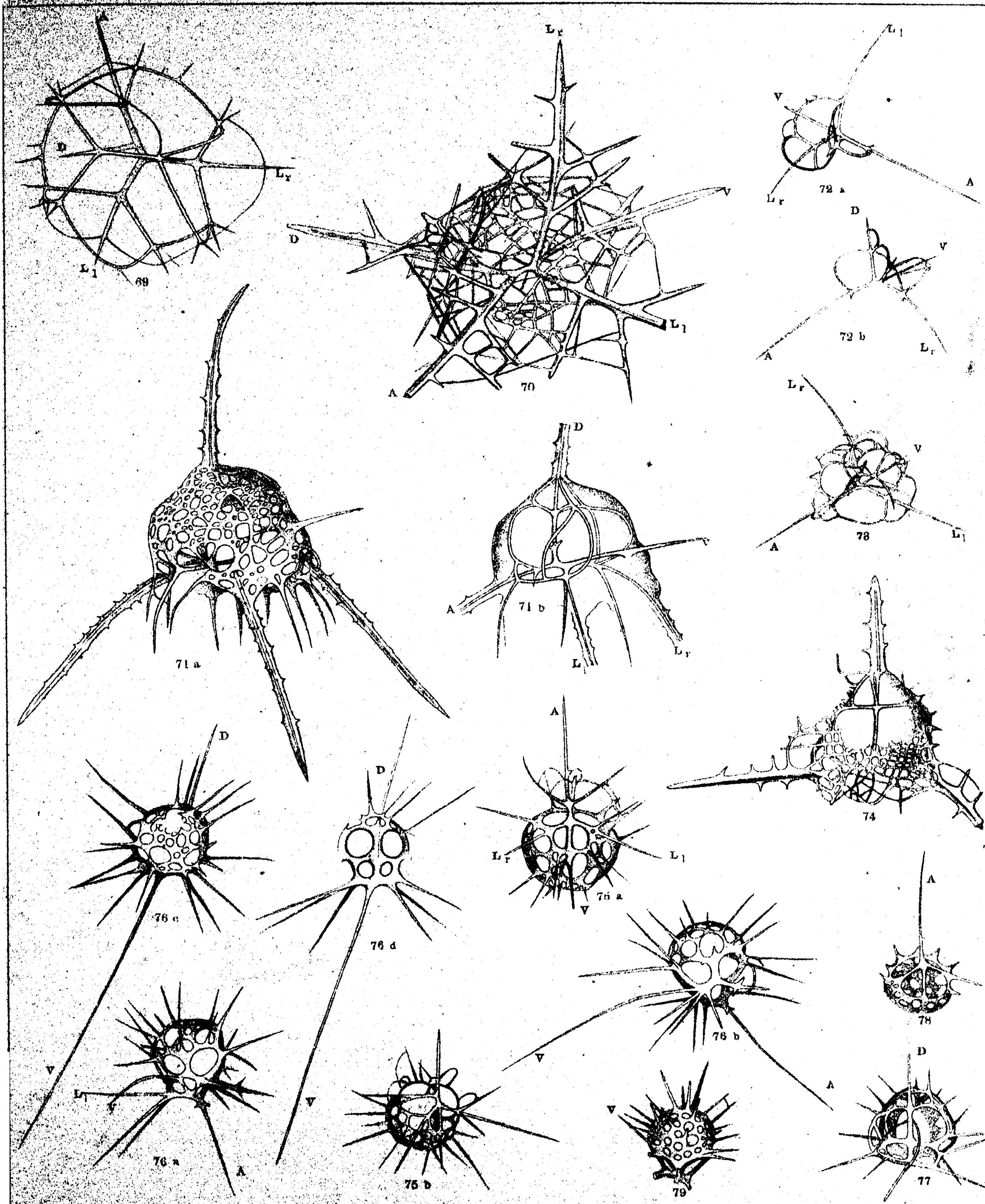
c. Apical view; the very long ventral sagittal spine is seen.

d. The same, lower optical section, showing the meshes about the spines D and V.

„ 77. *P. longispinum* Jørg., $^{450}/_{1}$. Øxsund, $^{17}/_{3}$ 1899, 600 m. Not fully developed specimen; dorsal view. Diameter of the network 34 μ.

„ 78. *P. longispinum* Jørg., $^{880}/_{1}$. Helligvær, $^{12}/_{1}$ 1899, 0—250 m. Ventral view.

„ 79. *P. longispinum* Jørg., $^{380}/_{1}$. From the same locality. Lateral view. Cephalis 50 μ long, 42 μ broad.



E. Jörgensen del.

PLATE XVI.

PLATE XVI.

Fig. 80. *Peridium longispinum* JØRG., $^{450}/_1$. Senjen, $^{21}/_1$ 1899, 0—130 m. Fully developed specimen. Lateral view; the left lateral arch ($\mathrm{L_l}$), with two strong byspines, in front.

" 81. *Lithomelissa setosa* JØRG., $^{450}/_1$. Henningsvær, $^{17}/_1$ 1899, 0—180 m. Young specimen. Dorsal view; the spine A in front, somewhat to the left (directed downwards).

" 82. *L. setosa* JØRG., $^{450}/_1$. Apical view.

" 83. *L. setosa* JØRG., $^{450}/_1$. The Herlø Fiord (near Bergen), $^{24}/_5$ 1899. Almost fully developed specimen; lateral view.

" 84. *L. laticeps* JØRG. n. sp., $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m. Lateral view.

b. The same, optical section, showing the main spines.

" 85. *L. hystrix* JØRG., $^{450}/_1$. Skroven, $^{1}/_3$ 1899, 0—300 m. 50 μ high and broad. Thorax 36 μ high; cephalis 14 μ high, 25 μ broad. Most of the spines broken off.

" 86. *Helotholus histricosa* JØRG. n. sp., $^{450}/_1$. Øxsund, $^{17}/_3$ 1899, 0—300 m.

a. Inside the shell the long axial divided spine is seen.

b. Antapical view of the cephalis and the upper part of the thorax (neck stricture). 4 spines are seen.

" 87. *H. histricosa* JØRG., $^{380}/_1$. From the same locality. Young specimen.

b. Portion of a broken shell, showing the protruding ventral, sagittal spine.

" 88. *H. histricosa* JØRG., $^{450}/_1$. Ofoten II, $^{7}/_3$ 1899, 0—100 m. Apical view. Diameter of the thorax 94 μ, of the cephalis 27 μ. Pores very uneven, from 5 to 20 μ.

" 89. *Dictyophimus histricosus* JØRG. n. sp., $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m. Shell 68 μ high, 85 broad; cephalis 22 μ high, 34 broad. Pores uneven, from 9 μ to very small, not considerably smaller on the cephalis.

b. The same; optical section, showing 4 main spines. The three swellings, mentioned under *Lithomelissa setosa* (above p. 127) and other species, are distinctly seen.

" 90. *Litharachnium tentorium* HCK. Sea north of Shetland, 63° 36′ n., 0° 32′ e., $^{11}/_3$ 1903 (S/S Michael Sars).

a. The entire shell of a fully developed specimen, $^{200}/_1$.

b. Upper (conical) part of the shell, $^{450}/_1$.

c—e. Pores and parts of the network, $^{660}/_1$; c from below the broken part of the shell, e the largest pores of the cone, above the beginning intermediate ribs, d farther down on the cone, where intermediate ribs appear.

" 91. *L. tentorium* HCK., $^{450}/_1$. Skroven, $^{4}/_4$ 1899, 0—150 m. Young specimen.

a. Lateral view.

b. Apical view. The 3 primary meshes in the neck stricture are seen.

c. A portion of the network near the margin below.

Pl. X 4.

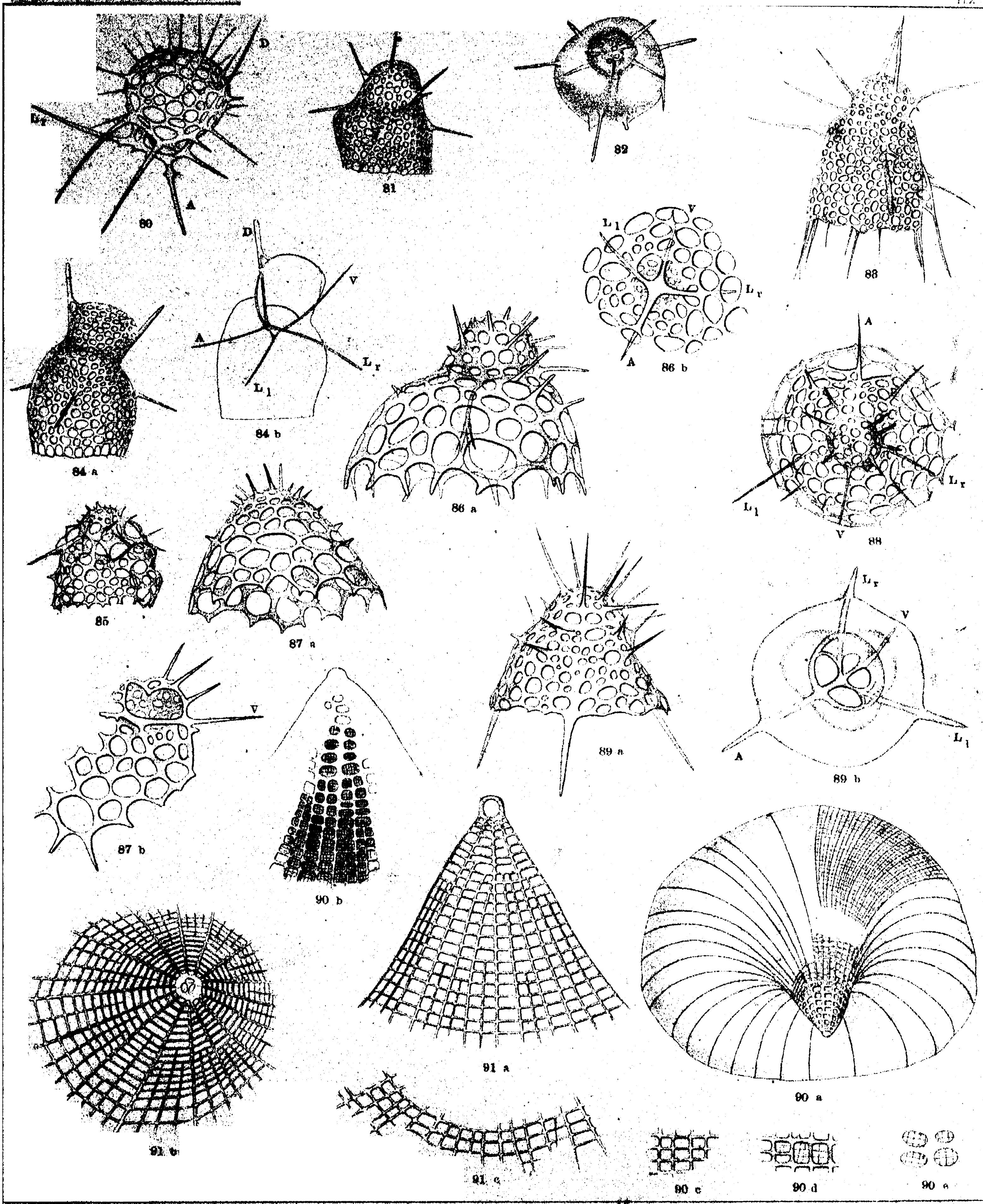

80
D
L_r
A
81
82
83
84 a
84 b
D
V
A
L_r
L_1
85
86 a
86 b
V
L_1
L_r
A
87 a
87 b
V
88
A
L_1
L_r
V
89 a
89 b
L_r
V
A
L_1
90 a
90 b
90 c
90 d
90 e
91 a
91 b
91 c

PLATE XVII.

PLATE XVII.

Fig. 92. *Androcyclas gamphonycha* (Jørg.) Jørg., $^{450}/_1$. The Herlø Fiord (near Bergen), $^{21}/_6$ 1898, 0—400 m. A well developed specimen with very strong and numerous byspines. Cephalis 38 μ (long) × 34 μ (broad); thorax 42.5 × 76; abdomen 110 × 110; tophorn 64 μ.

„ 93. *A. gamphonycha* (Jørg.) Jørg., $^{450}/_1$. Ofoten II, $^{7}/_2$ 1899, 0—100 m. Antapical view, showing the main spines (except the spine D), the „collar septum" (Hck.) and the outlines of the shell.

„ 94. *A. amblycephalis* (Jørg.) Jørg., $^{450}/_1$. Øxsund, $^{17}/_2$ 1899, 550—620 m. Shell 102 (long) × 90 μ.

„ 95. *A. amblycephalis* (Jørg.) Jørg., $^{450}/_1$. The Vest Fiord I, 0—180 m., $^{13}/_1$ 1899. Young specimen. Cephalis 27 μ broad, thorax 72 μ. Cephalis as yet open above; abdomen not yet developed, only indicated through some marginal spines below.

a. Lateral-ventral view; the spine L_r in front, a little to the right.

b. The same, lateral view. The inner septum, between thorax and abdomen, is seen.

„ 96. *A. amblycephalis* (Jørg.) Jørg., $^{450}/_1$.

„ 97. *A. amblycephalis* (Jørg.) Jørg. Apical view, showing the cephalis open above.

„ 98. *Clathrocyclas craspedota* (Jørg.) Jørg., $^{380}/_1$. Helligvær, $^{12}/_1$ 1899, 0—250 m. A well developed specimen; apical view. Greatest diameter of the abdomen 167 μ, of the thorax 138 μ, of the cephalis 42.

„ 99. *Cl. craspedota* (Jørg.) Jørg., $^{450}/_1$. From the same locality. Young specimen; abdomen as yet wanting.

a. Lateral view.

b. Apical view.

„ 100. *Cl. craspedota* (Jørg.) Jørg., $^{450}/_1$. Ofoten II, $^{7}/_2$ 1899, 0—250 m. Young specimen without abdomen. Cephalis 25 μ high × 42 μ broad below; the longest tophorn 127 μ.

a. Lateral view, showing the two strong tophorns.

b. Apical view.

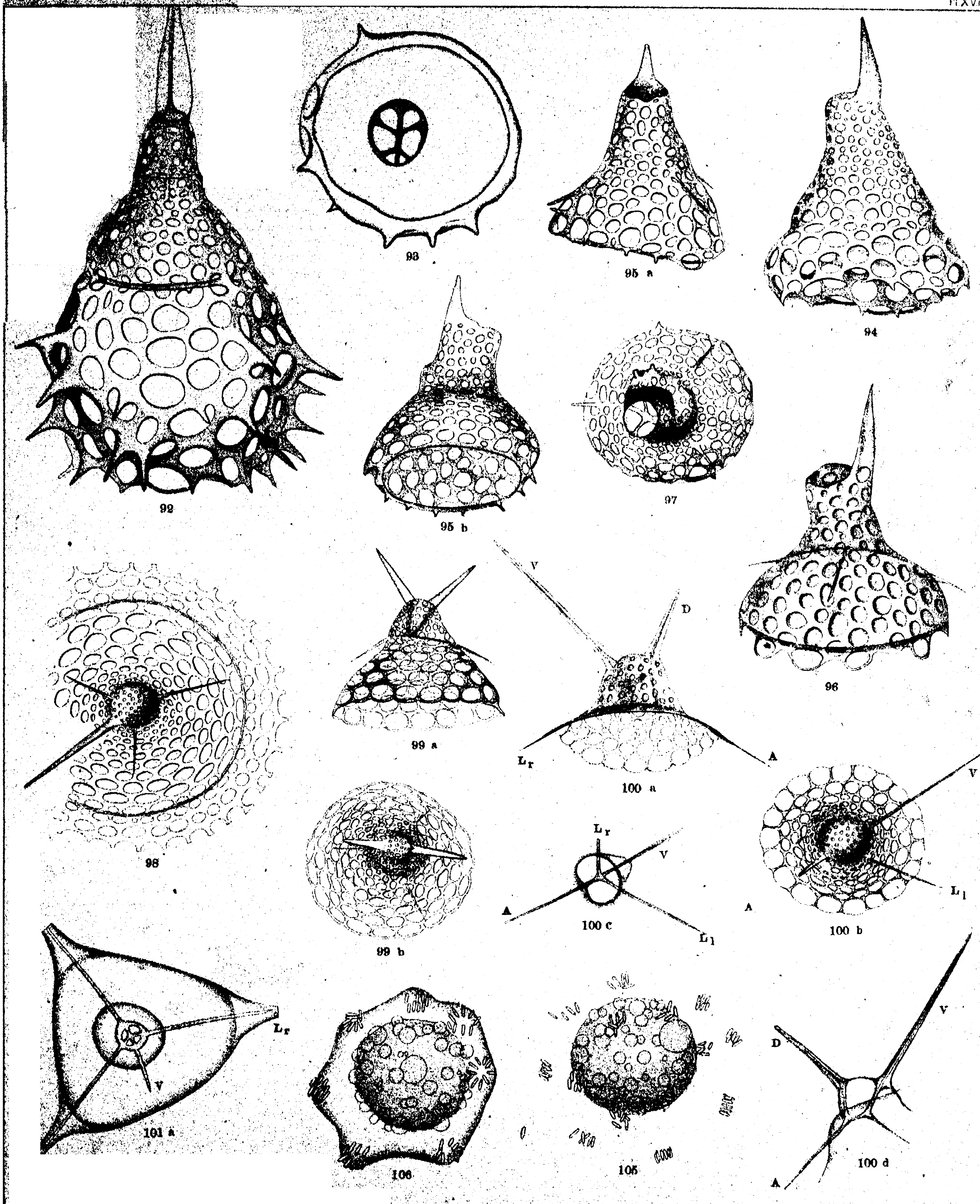
c. Optical section in the region of the „neck"; apical view. The main spines, except spine D, are seen.

d. Optical section, lateral view, showing the two tophorns protruding from the inner skeleton.

„ 101. a. *Dictyoceras acanthicum* Jørg., $^{450}/_1$. Skroven, $^{4}/_4$ 1899, 0—150 m. Apical view, showing the „collar septum", the main spines (except spine D) and the outlines of the shell.

„ 105. *Radiosphæra anacanthica* Jørg. n. sp., $^{450}/_1$. The Skjerstad Fiord IV, 0—330 m., $^{2}/_4$ 1900. Diameter of the central capsule 68 μ. The calymma quite invisible in water.

„ 106. *R. anacanthica* Jørg., $^{450}/_1$. Kvænangen II, 0—50 m. The calymma made visible through staining with safranine.



92
93
95 a
94
95 b
97
96
V
D
98
99 a
Lr
A
100 a
V
Lr
V
A
L1
A
100 c
L1
A
100 b
99 b
Lr
V
101 a
D
V
106
105
A
100 d

PLATE XVIII.

PLATE XVIII.

Fig. 101. b. *Dictyoceras acanthicum* JØRG., $^{450}/_1$. The Herlø Fiord (near Bergen), $^{25}/_4$ 1898, 0—400 m. Cephalis 33 μ high × 31 broad; thorax 73 × 101; abdomen 38 × 126 μ. Pores of the cephalis 3.5 μ, of the thorax 4—7.5 μ, of the abdomen 6—10 μ.

„ 102. *Stichocorys seriata* (JØRG.) JØRG., $^{450}/_1$. Øxsund, $^{17}/_2$ 1899, 250—350 m. A well developed specimen.

„ 103. *St. seriata* (JØRG.) JØRG., $^{450}/_1$. Sea off Aalesund, 61° 56′ n., 2° 40′ e., $^{10}/_2$ 1903, 0 m. (S/S Michael Sars). A well developed specimen.

„ 104. *St. seriata* (JØRG.) JØRG., $^{450}/_1$. Sea north of Shetland, 63° 36′ n., 0° 32′ e., $^{11}/_2$ 1903, 0 m. (S/S Michael Sars). A well developed specimen. Length (tophorn not included) 128 μ, greatest breadth 72 μ. Largest pores 6 μ long. The pores on the upper part are omitted in the figure.

[Figs. 105—106, on pl. XVII.]

„ 107. *Acanthocorys umbellifera* HCK. (?), $^{560}/_1$. The Oster Fiord (near Bergen), $^{12}/_6$ 1900, 200—400 m.; Cephalis 54 μ high × 46 broad, thorax 38 × 96.

„ 108. *Lithomelissa setosa* JØRG., $^{660}/_1$. Kvænangen, $^{24}/_1$ 1899, 0—140 m.

a. Lateral view; the spine L_l in front.

b. Ventral-apical view; the sagittal ventral spine in front upwards. The inner lattice plate between the spines V and L_l is seen; also the axial spine, a. The specimen not fully developed.

„ 109. *Amphimelissa setosa* (CL.) JØRG., $^{660}/_1$. Near Jan Mayen, S/S Michael Sars 1900, st. 19, $^{9}/_8$, 50—100 m. Young specimens (?).

a. Antapical view.

b. Another specimen; dorsal view.

„ 110. *Cannosphæra lepta* JØRG., $^{450}/_1$. The Herlø Fiord (near Bergen), $^{10}/_6$ 1898, 0—300 m. Some tangential and radial beams.

„ 111. *Challengeron Channeri* (MURR.) HCK., $^{200}/_1$. Sea, 40 miles NW of Gaukværø, $^{19}/_1$ 1899, 0—700 m. Peristome and radial spines broken off. The crossing lines in the middle indicate the structure of the shell.

„ 112. *Ch. armatum* BORG., $^{450}/_1$. From the same locality. Illustrated from a sketch, as the specimen was lost before a complete drawing could be finished.

„ 113. *Cadium melo* (CL.) BORG., $^{450}/_1$. Sea off Røst, $^{22}/_3$ 1899, 0—900 m. 85 μ long × 60 μ broad.

„ 114. House of *Leprotintinnus pellucidus* (CL.) JØRG., $^{450}/_1$. The Skjerstad Fiord IV, $^{3}/_4$ 1900, 0—300 m. Foreign bodies on the house much more numerous than usual.

„ 115. House of *Tintinnopsis nitida* BRANDT, *var. ovalis* JØRG. n. var.; $^{600}/_1$. Moskenstrømmen, $^{14}/_1$ 1899, 0—100 m. Length 48 μ, greatest breadth 38 μ; breadth of the mouth 22 μ.

„ 116. House of *T. nitida* BRANDT, *var. sinuata* (BRANDT); $^{380}/_1$. Moskenstrømmen, $^{13}/_1$ 1899, 0—50 m. Length 83 μ, breadth of the mouth 58 μ, breadth in the middle 46 μ.

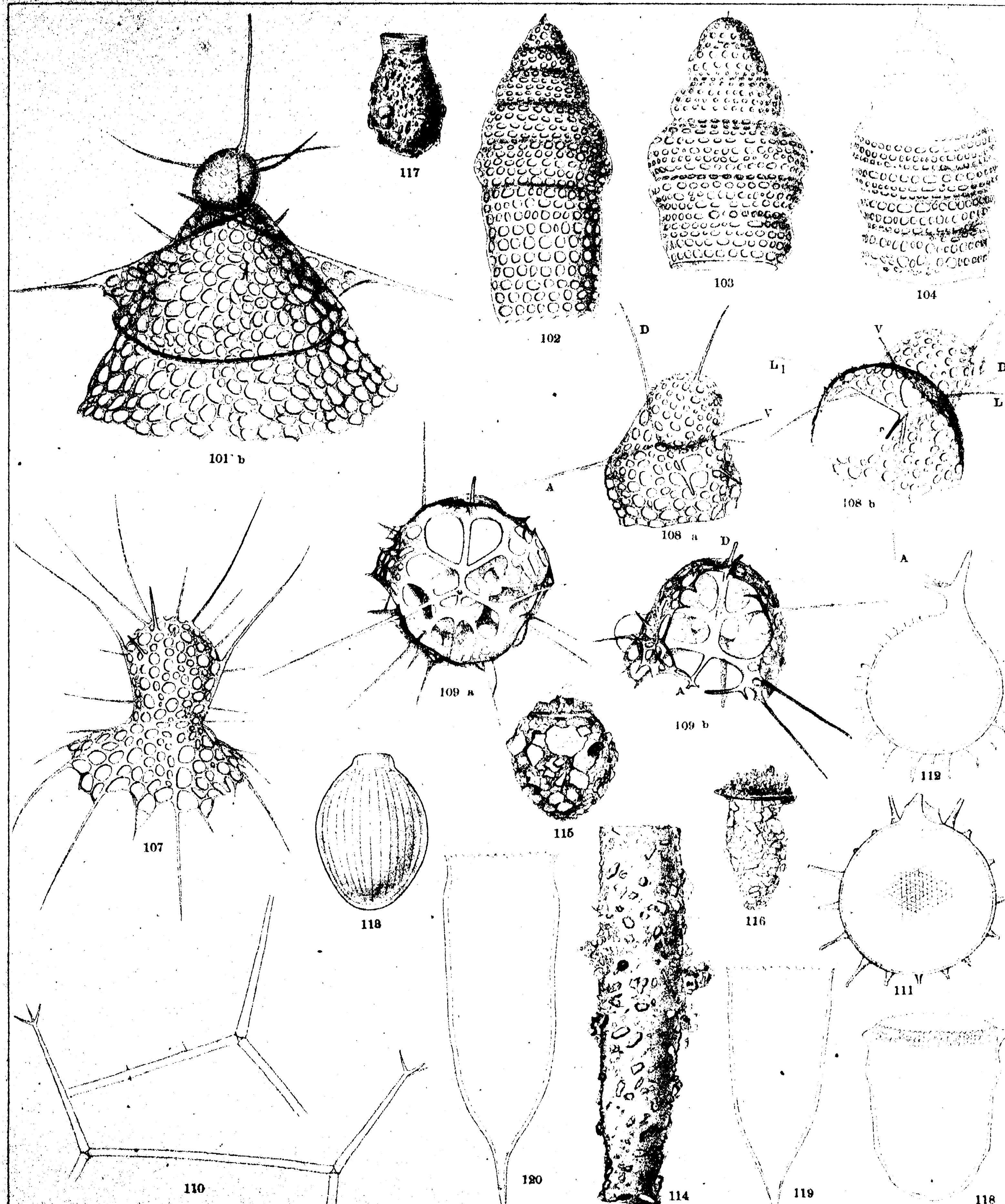
„ 117. *Codonella lagenula* (CLAP. et LACHM.) ENTZ, *var. ovata* JØRG.; $^{500}/_1$. From the west coast, near Bergen.

„ 118. *Ptychocylis urnula* (CLAP. et LACHM.) BRANDT *var. subarctica* JØRG. n. var; $^{380}/_1$. Lyngen II, 0—250 m., $^{27}/_1$ 1899. The plicæ of the house only indicated near the mouth, where they are more conspicuous.

„ 119. *Cyttarocylis denticulata* (EHRB.) FOL., *var. subedentata* JØRG. n. var.; $^{450}/_1$. Kvænangen I, $^{24}/_1$, 0—50 m. Length 111 μ, „tail tip“ 12 μ; breadth of the mouth 49 μ. 36 teeth. Areoles omitted in the figure.

„ 120. *C. denticulata* (EHRB.) FOL., *var. subedentata* JØRG.; $^{450}/_1$. The Øgs Fiord, $^{14}/_2$ 1899, 0—90 m. Length 145 μ, tail 34 μ; breadth 51 μ. 36 teeth. Areoles $2^1/_2$ on 10 μ, omitted in the figure.

[Fig. 121 on pl. XIV].



E. Jørgensen & H. Bucher del.

PLATE XIX.

PLATE XIX.

Temperature curves.

I. Tranødybet, $^{6}/_{2}$ 1899.

II. Tranødøbet, $^{16}/_{3}$ 1899.

III. The Sea NW of Røst, $^{22}/_{3}$ 1899.

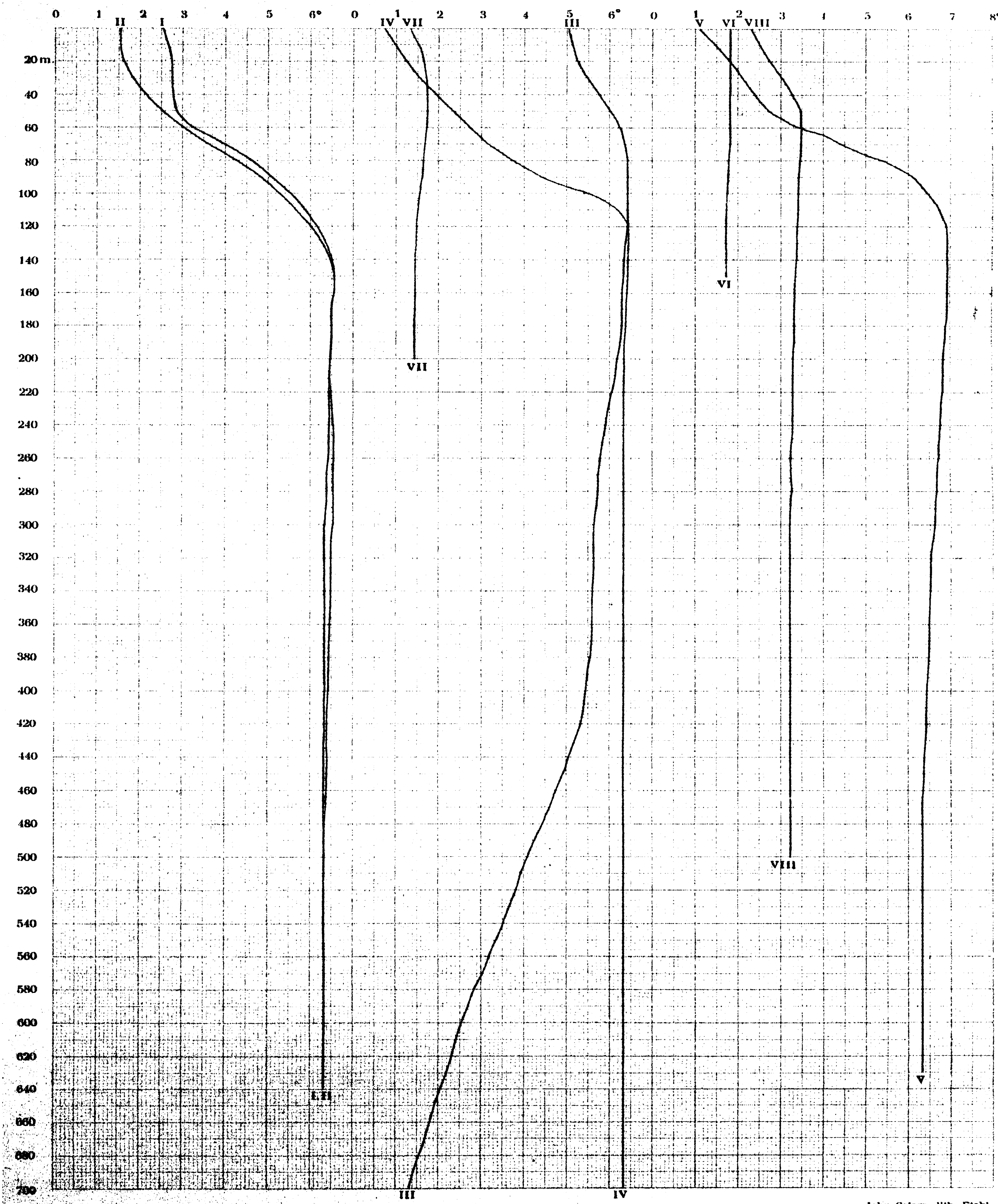
IV. Tys Fiord I, $^{28}/_{3}$ 1899.

V. Øxsund, $^{17}/_{2}$ 1899.

VI. Skjomen II, $^{9}/_{2}$ 1899.

VII. Øgs Fiord II, $^{14}/_{3}$ 1899.

VIII. Skjerstad Fiord XII, $^{4}/_{2}$ 1900.



John Griegs lith. Etabl.

PLATE XX.

PLATE XX.

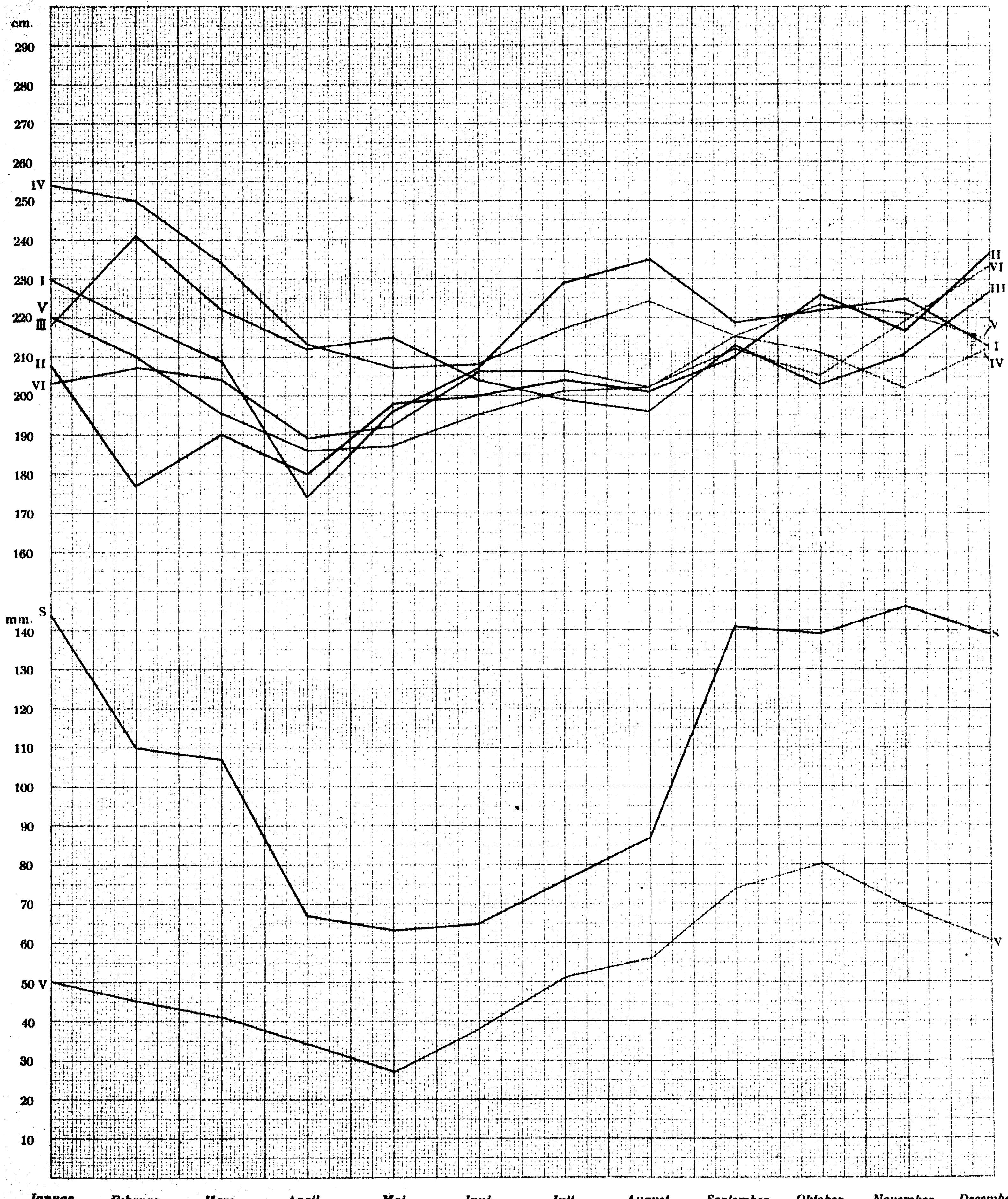
The monthly average heights of water at Kabelvaag (red curves) and Vardø (blue curves)

I. 1882	IV. 1882
II. 1884	V. 1884
III. 1885	VI. 1885

The average monthly downfall at

Svolvær	and	Vardø
S (red curve)		V (blue curve).

From „Vandstandsmaalinger" ed. by „Den norske gradmaalingskommission" and „Nedbøriagttagelser i Norge" ed. by „Det norske meteorologiske institut".



John Griegs lith. Etabl.

PLATE XXI.

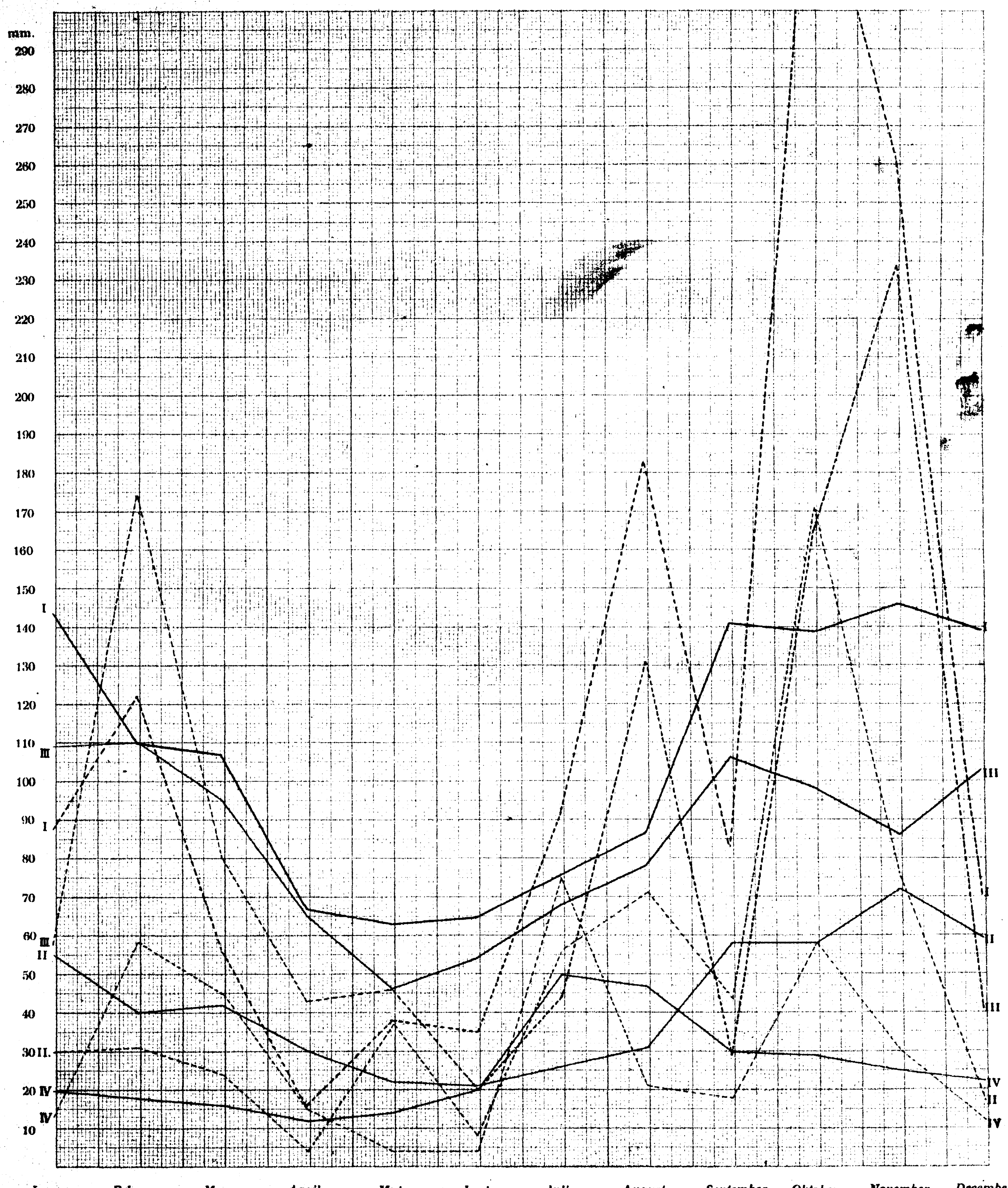
PLATE XXI.

Downfall curves.

The crossed lines (- - - - -) represent the monthly average downfall of the year 1899, and the straight lines (——) show the normal monthly values for

I. Svolvær (black curves).
II. Skomvær (blue curves).
III. Tromsø (red curves).
IV. Alten (green curves).

From „Nedbøriagttagelser i Norge“ ed. by „Det norske meteorologiske institut“.



John Griegs lith. Etabl.